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The Physiographic History of Five River Valleys in Northern Ohio

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THE PHYSIOGRAPHIC HISTORY OF FIVE RIVER VALLEYS IN NORTHERN OHIO

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PURPOSE

The purpose of this paper is to explain as far as possible with the data at hand the origin of the five river systems of the area and the physiographic features of their valleys.

First, each of the five river valleys will be taken up in a general way; then particular sections of the valleys will be described in detail after which some of the physiographic features will not fully explained in the detailed descriptions of the river valleys will be discussed..Finally summary conclusions will be made.

ACKNOWLEDGEMENTS

I wish to thank Dr. George D. Hubbard Professor of Geology in Oberlin College for the kind and helpful assistance both in the preparation of this paper and in the pursuit of the field work.

METHOD OF INVESTIGATION.

The early part of the field work was done in the Fall of 1923. Particular sections of the valleys were visited and examined as to their physiographic features. The question of the origin of the valleys was continually kept in mind. Various ruling hypotheses (1) were tried and disproved.

It was soon found that many factors were involved and that explanation would not be simple. As the field work progressed and a very much greater number of physiographic forms were discovered in their developement; more and more stages in the developement of the same forms were seen. Thus, process became something that could be seen with sharper definiteness than before. Physiographic forms enlarged their concepts to include many developemental stages.

The latter part of the field work was done in the early Spring of 1924 after the pursuit of a course of reading through the Winter. The literature thus covered is listed in the bibliography. The later field work grew more interesting as surer grounds for broader generalizations were reached.

1 Chamberlain, T. C. The Multiple Hypothesis
Jour. Geol. Vol. 5. p. 837

Introduction

THE AREA STUDIED.

The area studied is a portion of northern Ohio about midway in the State from east to west and north of the divide between the Erie and Ohio drainage basins. It embraces parts of Sandusky, Erie, Huron, Lorain and Cuyahoga Counties with portions of Seneca, Wyandot, Crawford, Medina and Summit Counties farther south. The area is enclosed by parallels 81' 50' and 83' 6 "West Longitude and parallels 40' 50' and 41' 30" North Latitude. Field work actually covered only five narrow strips extending from the divide some twenty to thirty miles, northward to Lake Erie. These strips from east to west are the valleys of Sandusky, Huron, Vermilion, Black and Rocky rivers with their main tributaries.

The Sandusky River is mapped on the following U.S. G.S. Topographic sheets; Bucyrus, Sycamore, Marion, Upper Sandusky, Tiffin, and Fremont. The map of Huron river is found on Norwalk and Sandusky sheets. Vermilion-- River is found on the New¢ London and Vermilion sheets; Black River is found on the New London, Oberlin and Wellington sheets; and Rocky River on the Cleveland, Medina, and Berea sheets.

PHYSIOGRAPHIC PROVINCES** The region ~~studied~~ is located on the Lake and Till Plains of the southern margin of Lake Erie in the eastern part of the Great Lakes drainage basin and so the history of our area is linked up rather closely with that of the Great Lakes and of Glaciation in North America.

STRUCTURE

The structure of the area is simple; upper Paleozoic strata dip east ~~and~~ south on the eastern limb of the Cincinnati

Structure—

anticline. The strata lie nearly horizontal. There are no local anticlines or synclines of any importance. There is however, in some places local bowing up of Devonian and Mississippian shales accompanied by slight shearing, faulting and brecciation. There is a fault of 8 feet at Lodi in the Cuyahoga formation. The structure has very little to do with the subsequent history of the rivers. Initial drainage may have followed jointing and fissuring in the shales but as there are no important faults this does not seem likely.

1-VanHise, C.R. Origin of the Dells of the Wisconsin.
Trans. Acad. Wis. Sci. Vol. 10. 1895 p.558.

Physiographic History of Five River Valleys in Northern Ohio

By George D. Hubbard and Milton M. Champion*

*In its original form this paper was submitted as a part of the requirement for the degree of Master of Arts in Oberlin College 1924. Since the degree was granted to the junior author the paper has been revised jointly so as to ~~reduce it and make it more like a thesis~~ size. ~~Many details which were profitable in the thesis but which could be dispensed with in publication have been omitted.~~ While it has been cut 25% the authors do not think its value as a description and explanation has been impaired.

The field was carefully gone over by Mr. Champion in his studies. Extensive reading both on Ohio valleys and on the general problems presented. The appended bibliography does not show the extent of this work.

Practically all of the ~~material~~ territory described in this paper ~~was~~ has been seen by the senior author and the paper, in its present form, is in all respects a joint paper.

GENERAL PHYSIOGRAPHIC HISTORY

Physiographic history is told not only by what we can see at the surface but what is buried in the rocks; we must look to the stratigraphic record. Just as we can trace organic evolution by fossils in the rocks so can we trace physiographic history by the character of the rock itself. Planes of unconformity give us a clew to the nature of former erosion surfaces; irregular unconformity surfaces indicate great relief while smooth erosion planes show peneplanation. (1) Abrupt escarpments in the erosion plane of unconformity indicate buried gorges.

The stratigraphic record of the area so far as now obtainable begins with the deposition of Niagara limestone in a deep, clear water, inland sea. Then uplift occurred, followed by erosion and submergence, after which the dolomitic Monroe limestone was deposited. These limestones are met with in the western part of the area, cropping out along the Sandusky River from Tiffin to below Fremont.

Unconformably overlying the Monroe is the Onondaga of older workers, limestones of Devonian age, represented by the Columbus limestone, the hard blue Delaware limestone and the blue argillaceous Olentangy Shales.

(2) Gradual and repeated but small uplifts of the Cincinnati arch (1) occurred with deposition of black shales and other rocks of later age on its flanks. (certain of these contain abundant fish remains.) The shale group is represented by the Huron, a dark blue shale with many clay ironstone concretions whose centres have crystals of pyrite, calcite and celestite; the gray blue Chagrin shale and at the top the fine grained dark blue fissile Cleveland shale. These three make up the Ohio shale group (3) and are found

cropping out in many ob the river ~~gorges~~ bluffs and in the lake cliffs.

After the Cleveland shale was deposited an uplift and local erosion resulting in an unconformity occurred before the deposition of the Bedford shale of Mississippian. This unconformity can be seen in the lower course of Vermilion River gorge. The Bedford shale is reddish in Vermilion and Black River valleys and so indicates further uplift of contiguous land surfaces under arid conditions. Another oscillation brought the Bedford shales out of the sea and they were subjected to some local erosion before the heavy grits of the Berea sandstone formation were deposited.

Wider areas of land were rising from the sea; semi-marine conditions such as were prevalent during the deposition of the Coal Measures set in. The Berea grits indicate rugged shoreline conditions not far away.

out (1 Davis W.M. Planes of Marine and Subaerial Denudation.
G.S.A. Bull Vol. 7 1896 pp 377

1 2 Columbus Folio 197 U. S. G. S. p 6. Ohio Geol Sur. Bull. 10 p24.25, 112-129

out 3 Idem p 7. Ohio Geol. Sur. Bull. 15. p465-508

The overlap ~~of the sea~~ of the sea was from the southeast so that in our area the later formations as the Cuyahoga were not deposited except in the far eastern part. Their character was ~~semi-marine~~ largely and shallow seas depositions took place in marshes and lagoons, along a low coast line. (At this time the rivers of our area all flowed off to the southeast, following a dendritic pattern similar in their ~~direction~~ flow out to the present rivers of the southern and eastern parts of the state.)

The convergence of the different lake basins of the Great Lakes Region toward Hudson Bay may indicate a Tertiary (?) drainage system northward. There are various theories however proposed ~~as~~ to

explain the origin of these basins. (a) The Glaciers may have scooped out the basins; (b) (c) The Basins may be the result of crustal warping. (c) The weight of the ice might have caused depression. (d) Glacial deposition. Even if the glaciers formed these basins, their original direction would still have been determined by older drainage patterns. Probably all three factors are responsible; namely; Tertiary erosion, crustal warping, and glaciation. depression and glacial deposition.

Throughout Tertiary time erosion was going on in the Great Lakes Region, while the Red River (b) region was being worn down. This Tertiary erosion cycle was very long for it resulted in the broadening out of the river basins opening in the direction of Hudson Bay, into very mature to old valleys. The preglacial valleys of our area were a part of the Erie River System, Erie River flowing west through the central part of Lake Erie parallel with its longer axis. The Great Lakes occupy in part these Tertiary River System basins.

The hypothesis that the weight of the glaciers warped down the crust of the earth explains the present uptilting to the northeast, because when the glaciers withdrew, the resiliency of the earth's crust would respond with gradual uplift. (7) This may be a factor in the present explanation of the drift divide, and the lakes themselves. As the glaciers retreated the territory just evacuated would respond with uplift which would pond back the water in front of the melting ice. The drainage would not be away from the glaciers, as was the case with the outwash plains and eskers, but directly toward their retreating fronts, thus causing lakes wherever free flow was prevented.

There occurred five or six incursions of the glaciers; in our area three distinct invasions of the ice are known. The first two deposited a blue, unoxidized drift analogous to the Illinoian; the third brought the light oxidized drift of Wisconsin age. In the

Interglacial Periods our area may have been the scene of re-excavation of broad Tertiary valleys ~~can be seen~~ as suggested by buried gorges. These gorges could not have been the result of pre-Pleistocene erosion as at this time the area was broadly peneplained and gorges would be inconsistent unless made immediately preglacially by waters partially impounded by the ice.

1 Wilson W. A. G. Laurentian Peneplain

2 Grabau, A. W. Niagara Falls and Vicinity
New York State Museum Bull. 45 v. 9 Apr. 1901
pp 37-54

3 Spencer, J.W.W. Falls of Niagara
Canada Dept. of Mines. Geol. Survey. Branch
1905-6 pp 412-426

4 Russell I.C. The Laurentian Basin
G. S. A. Bull. Vol.3
Journal Geol. vol. 1 p 395

~~5 Idem~~

6 Upham Warren Glacial Lake Agassiz
Mon. 25 U. S. G. S p 20

7 Hobbs, W. H. Earth Features and their Meanings 344-347

8 Wilson, W. A. G The Laurentine Peneplain
Journal Geol. Vol. 11 1903 p645

As the glaciers retreated for the last time proglacial lakes were formed the first of which was Lake Maumee, covering the west end of Lake Erie and the northeastern part of Indiana as far west as Ft. Wayne. Its outlet was by way of the Wabash, Ohio and Mississippi rivers. By farther retreat of the glacier front and the uncovering of a lower outlet, the lake fell to the Whittlesey stage; its outlet was by way of Ubley, through central Michigan into Lake

Chicago; from there its route was by way of the Chicago, DesPlaines, Illinois and Mississippi rivers. The third lake stage was Lake Warren whose outlet was through a lower channel north of Ubley and through Grand River into Lake Chicago; from there on the route was that of Lake Whittlesey. (4) Finally the drainage of the Great Lakes Region was reversed (5) in the direction of the St. Lawrence basin due to farther retreating of the ice and uncovering of lower outlets to the east (6) The passage was first across the Niagara limestone escarpment. Niagara Falls has cut back a distance of seven miles in this rock. This change did not occur without a struggle with a subsequent outlet by way of Lake Temiskaming and the St Croix River.

It is just before the Lake Maumee stage that the rivers (7) of our area began cutting through the till. Some of these rivers first emptied into wide embayments in the lake a little south of their present forks. The present branches of these rivers were separate streams at that time. The history of these rivers has been one of repeated rejuvenation with periods of stability caused by the stand of the temporary lakes, Maumee, Whittlesey and Warren and by their rapid lowering from one level to the next. This stability is shown by temporary base levels with reference to shore lines. The present erosion cycle is one in which the post-glacial streams north of the drift divide are deepening their beds in lake clay, drift and occasionally in Paleozoic strata. These rivers may be charaterized as young although in places defended terraces demonstrate advanced youth. (8)

1/ Leverett, F. Mon. 53 U. S. G. S. 1915

2/ Pirsson L.V. and Schuckert, C.E. Textbook of Geology, 1915. p.951

3/ Carney, Frank Abandoned shore lines of the Oberlin Quadrangle. Bull Sci Lab. Den. Univ. 1910 p.102

~~3 Garney, Frank. contd. Bull. Sci. Lab. Denison Univ., 1916 p. 102~~

4 Fisher, W. D. Terraces of the West River (Conn)
Proc. Boston Soc. Nat. Hist. Vol. 33 p 40

GENERAL PHYSIOGRAPHIC FEATURES.

The Physiographic history of this region has just been outlined ~~(up to the present)~~ and there remains to be pointed out some of the general physiographic features of the area before describing the river valleys in detail.

The area consists of Till and lake Plains, sloping gently north to Lake Erie; the altitude of the drift divide is approximately 1,000 to 1100 feet ft. that of Lake Erie 573 ft. while the altitude of the intervening Lake Plain is from 600 to 780 ft and the Till Plain rises from 780 ft up to the divide. The Till Plain is generally level but slightly hummocky in places, whereas the Lake Plains have an even more level surface. These Lake Plains however are not wholly featureless for they are set off into strips, roughly parallel with Lake Erie by ancient lake ridges. (1) These lake ridges are prominent and continuous across the entire state, representing former Post Glacial lake levels. They are Buttermilk Ridge represents the Maumee shoreline, Middle Ridge the Whittlesey, and North Ridge the Warren shoreline. There were minor ridges such as Sugar ~~Ridge~~ and Chestnut ~~Ridge~~ which ~~were~~ may have been formed as off shore bars, ~~enclosing lagoons.~~

These ridges attain an altitude of from 10-20ft. above the surrounding lake plains and are perceptable as gentle elevations of very regular outline. Because of their good drainage these ridges are utilized for road beds, residences, orchards, gardens and cemeteries.

The main features of the prsent lake shore are escarp-

ments of blue fissile Ohio shale, rounded cliffs of buff, yellow lake or glacial drift clay, drowned river mouths with marshy inlets and the parrallelism and several sections of Sandy beach of most of the streams, run parallel about with the lake beach, just prior to their embouchure.

In contrast to the level Lake Plains are the more uneven Till Plains which are hummocky with glacial features such as kettles & knobs and eskers. Glacial boulders of red and green granite and gneisses as well as red and ~~white~~ green, tillites are scattered everywhere over the plains. In intermoraine areas marshes are developed. Surface erosion has gone on far enough to produce little valleys and creeks which eventually reach the main streams of the area. The limestone country around Bellevue has underground drainage, and, as in Karst country, sink holes are numerous.

The Till and Lake Plains are being dissected by streams which have cut ~~deep gorges~~ deep gorges in their lower courses (10) (2) meandering in and out in a sinuous northerly ~~course~~ direction. There the gorges are cut into Devonian and Mississippian shales, their sides are steep; where cut in till their sides are gently rounding and where cut in Silurian limestone their sides are low and rough.

9 Gorsey, Frank — Abandoned Shorelines of Vermilion Quadrangle
Bull. Denison Univ. Sci. Lab. vol. 18 pp 362-369

10 2 Dewey, Henry — Origin of some River Gorges in Cornwall
~~2 Dewey, Henry~~ — Q. J. G. S. Vol. 72 p65

7a insert

~~GENERAL DESCRIPTION OF~~ SANDUSKY ~~RIVER~~ VALLEY General

The Sandusky River rises in ~~Sandusky~~ Jackson township, Crawford County in several creeks and runs around Crestline ~~a few miles south of Sulphur Springs and northeast of Bucyrus.~~ The river flows southwest from the outer foot of ~~Defiance~~ Wabash moraine ~~and~~ which it follows ~~it~~ westward along its southern slope in a circuit-

ous course until it breaks through the morains ~~at Upper Sandusky.~~ on the Wyandot-Crawford county line
It then receives Broken Sword Creek and follows the Wayne moraine until
it breaks through that ~~The river drains the larger part of Crawford, Wyandot, Senec~~ in Pitt township Wyandot County. From here it bears northward (over)
Seneca and Sandusky Counties. The upper course drains Till Plains
and ~~three Defiance~~ moraines, the middle part limestone and lake clay
plains, while the lower reaches of the river drain only Lake Plain.

This is the longest river studied having a water course of nearly a hundred miles. The river has a winding and irregular course except for four miles directly north of Tiffin where the valley is narrow. From Fremont north the valley opens out very much and becomes shallow

The Sandusky River does not present the phenomenonof bifurcation 12-15 miles south of Lake Erie as do Huron, Black and Rocky Rivers. On account of the Karst country through which the river passes, it has few tributaries of the normal dendritic drainage pattern type. Its few tributaries, almost make falls when they enter the main stream, for, because of their lesser volume, they are unable to keep up with it, in its erosion of the resistant Niagara limestone (1) Below Tiffin Other tributaries from the east side are Sycamore, Willow, Morrison, Honey, Sugar, Bark ~~and Indian~~ Creeks while from the west side enter ~~Sycamotee~~, Muskellunge and Wolfe Creeks. These tributaries flow parallel with the main stream for the greater part of their courses showing them to be the result of sonsequent drainage of the till and lake plain slopes.

The gradient of the river from Tiffin to the mouth is ~~3 1/2~~ three and one half feet per mile, from Tiffin to Fremont 5 feet per mile and from Fremont to the mouth 1 and 2/3 feet per mile. The gradients of the tributaries are generally much greater ~~due to their rise on the till plains in lakes and their courses.~~ From Fremont north as we can see from the gradient of the streamthe river is nearer grade than above Fremont, showing the progress ~~progress~~ of erosion on the main stream. (11) This steeper gradient is also seen in the presence of several dams just north of Tiffin.

The river rises in an area underlain by Columbus limestone; south of Tiffin, Monroe limestone makes the stream bed: (2) from here north almost as far as Fremont, Niagara limestone crops out along the river banks, then the river flows half way to the Lake in Monroe limestone and the rest of the way in a Niagara limestone bed. The river has exposed several buried valleys, one south of Port Seneca, one two miles farther north and one at Fremont. In the limestone the river gorge is shallow compared with the ~~river~~ gorges of the other rivers in shale and sandstone. This is because of the difficulty with which the limestones are eroded. Near the mouth where the stream works in lake clays its meanders are long and gradual and its banks are low. Here the river has almost reached grade as shown by contiguous marshy areas. (4)

out 1 Folio 197 U. S. G. S. page 4

11 Davis W. M. The Geographical Cycle
Geographic Essays pages 266-272

out (5 Folio 197 U. S. G. S. page 4)

12 Newberry J. S. Geol. Surv. Ohio 1878 593, 611 and 625

~~DESCRIPTION OF THE VALLEY OF SANDUSKY RIVER FROM BUCYRUS TO TIFFIN~~ The Valley in Detail.

East ~~West~~ of the Bucyrus Reservoir the valley of Sandusky River is ~~narrow with sloping valley sides above.~~ West of the town the river meanders ~~in a very much wider valley;~~ ~~three~~ miles to the southwest the river entrenched itself in the ~~its wide valley~~ drift. The upper bluffs are moderately steep and are far back from the stream. ~~Two~~ Three miles ~~farther southwest~~ below Bucyrus there is an isolated hill close to the north side of the valley. ~~Just to the south there is an island which when the stream cuts down further may become an isolated hill also.~~

~~Just~~ north of Wyandot ~~the river turns northwest where it begins to break through the Defiance moraine.~~ Two miles ~~to the north there are two more~~ isolated hills. Three miles southeast of Upper Sandusky the valley widens and the stream follows a meandering course, in its broad floodplain.

North of Upper Sandusky the river ~~leaves its drift bed and~~ cuts into hard resistant limestone. ~~Here the~~ river turns east where there are rock terraces on the north side of the valley and a broad floodplain on the south. The upper bluffs are composed of lake clay while the lower ones are composed of resistant limestone. The river meanders northeast then zigzags north. This winding course is not due to normal shifting of the stream as is the case with normal meandering but it is due to Till Plain irregularities.

(13)

13. Leverett Frank Glacial Formations of the Erie and Ohio Drainage Basins. Mon. 41 U. S. Geol Surv. pp 583-604

North of Old Tymoochtee the river is met by Tymoochtee Creek from the southwest which drains many square miles of Till Plain in that region. Here the drift bluffs are rolling. For two miles north the stream purues a straight course in a limestone bed. The river turns east, north, ~~then~~ west, south then to get out around ~~of the way of a~~ glacial knobs which obstructs its path. This general crookedness continues to Mexico where the river turns into the big Defiance moraine. ~~The river continues in a northerly course with many~~ meanders ~~which~~ begin at the moraine. They increase in size ~~so that eight miles south of~~ a little down stream as the river gets large ~~Tiffin their loops are from three quarters to a mile in length.~~ (14) ~~The upper valley slopes are gentle and are far back from the stream.~~ The ~~river~~ meanders above the Maumee shoreline are an inheritance of ~~river meanders~~ those developed at the Maumee Lake stage. The old Maumee shoreline runs ~~just south of~~ through Tiffin. In Maumee time the river meandered back and forth on its broad floodplain just as rivers now often do near their mouths. When the lake level fell the stream entrenched itself again giving rise to terraces. Just south of Tiffin the meanders become straighter as the river cuts deeper into its resistant limestone bed. The upper bluffs slopes are often gently rounding while the lower ones are straight and steep.

Honey Creek enters the main stream from the east as a tributary of some ten miles in length. Tributaries of the region parallel the main stream for such a great distance because they are unable to reach the master stream and must follow the slope of the Till Plain.

(4) Davis W. M. Developement of River Meanders

Geol Mag. Decade 4 v. 10. 1903 p 146

~~DESCRIPTION OF THE VALLEY OF SANDUSKY RIVER FROM TIFFIN TO FREMONT.~~

Right in the town of Tiffin the ~~Sandusky~~ River is buttressed by walls so that its banks are not exposed. Where the river banks are exposed however, they present a bold front of crystalline dolomitic limestone, capped by several feet of surface soil, probably mostly lake clay; ~~and till~~; limestone is more and more exposed as the river cuts its way into this resistant formation.

The terraces at Tiffin present a rolling surface and possess at least two levels with two fronts, the upper terrace front being more rounded on account of longer exposure to subaerial erosion. Willow Creek enters the Sandusky River about a mile northeast ~~of the centre of~~ Tiffin where it ~~veritably falls over itself in trying to get to the main stream,~~ falls slower limestone ledges twenty feet in a half mile, ~~just before entering the river and exposing ledges of limestone,~~ a little farther down Morrison Creek does the same thing. Occasionally the terraces are defended by projecting ledges of, weathered ruggedlimestone, ~~limestone~~, drab and rounded, cherty and full of holes ~~in places.~~

Upon the upper terraces are found red granite boulders and greenish diorite rocks of glacial origin. These in company with the lake clays present the only evidence of glaciation in this part of the area.

The valley is the result of normal down-cuttings with successive halts as shown by occasional submature upper terraces. Here the down-cutting has been so rapid that there are neither meanders nor floodplains. Long ledges of whitish limestone crop out along the river banks. ~~See plate 1~~

In this resistant rock erosion produces gentle relief contours; and there are no decided bends in the river until it enters the drift of buried valleys, several miles north of Tiffin.

The upper slopes of the valley sides are submature. The concave curve of water (1) erosion here is more gentle then when found in drift. Evidences of former activity of the river are found in large pot-holes, undercuts and whirlpool basins high above the present stream.

The descent of the river across the limestone barrier is very rapid as shown by numerous rapids, a falls northeast of Tiffin and two dams farther down stream. The valley is rather narrow to a point three miles north of Tiffin where it begins to widen out. One mile south of here Morrison Creek enters from the east in a wide place in the valley, precipitating over limestone ledges as does Willow Creek farther upstream. It is thus seen that the laterals cannot keep up with the erosion of the main stream because of their lesser volume.

A quarter of a mile south of the Westerhouse Road bridge the landscape presents a hilly surface; the bluff is rounded and sloping and cut by deep laterals. In the flood plain is a large marshy area upstream from here.

A quarter of a mile north of the Westerhouse Road bridge the river turns a little east and falls over rapids, then follow smooth beaches (15) for we have passed the limestone bed and entered a buried valley. Here are the first evidences of drift deposition in the varied mass of all kinds of igneous pebbles and

1 Merrill J. H. Rock Weathering
Jour. Geol. Vol.4. 1895 p 859

15 Davis W. M. Elementary Physical Geography
p 255

attested by boulders of glacial origin found in the stream. (1) the absence of limestone outcrops and the presence of plastic clay banks. This plastic clay is exposed in a road cut a half mile north of the bridge mentioned above in the old Fort Seneca road. Just south of here there is a ravine which enters containing no limestone. The terraces of this ravine are hummocky and irregular, characteristic of erosion in glacial drift. This is more evidence of the buried valley.

DESCRIPTION OF THE SANDUSKY RIVER FROM TIFFIN TO FREMONT AND ITS LIMESTONE VALLEY.

This absence of limestone continues in the river banks for a half mile. In the drift area the river has characteristic clay banks with a deeper concave curve of water erosion (16) and more irregular bluffs with even rounded tops at the sky line. (17)

A mile and a half southeast of Fort Seneca the river meanders in two loops to the west in a wide mature-looking valley with upper step terracing and broad fertile flood plains. At Fort Seneca the river turns northeast in a preglacial drift filled valleys with the limestone some sixty feet below the surface of the Whittlesey lake clays. In the places where the river meets drift, it has more meanders with sharper bends. It was reported to me that limestone again cropped out a mile and a half to the northwest where the limestone strip is a half mile wide, thereupon again succeeded by a preglacial drift-filled valley two miles wide. When in the drift-filled depression the river cuts northeastward in most instences indicating the direction of preglacial drainage.

Two miles ~~northeast~~ of Fort Seneca the river enters and flows very tranquilly northward through buried valley section for about 2 miles; ~~westward in drift-filled area~~, then it is again confronted by the limestone through which it cuts a rather straight and narrow valley, all the way to Fremont. Wolfe Creek and its East Branch are both on the rock or ~~to Bellevue where it enters another drift-filled valley, having abandoned its older rock channel to the west.~~ The extreme western bluffs of its old valley are seen at the Soldiers' Hospital in Fremont. During the straight course into Fremont in the limestone area the river exposes many lime-stone ledges; the floodplains are narrow and the upper terraces are gently rolling. The river presents a typical erosion valley in a resistant sedimentary rock area. The absences of gorges and meanders is due to the resistence which dolomitic limestone offers to weathering; The presence of some underground drainage of much of the water that ordinarily would be taken in the surface run-off.

With this diminished volume there is a correspondingly diminished force in the erosion power of the river.

~~(1) Salisbury, R.D. - The Drift, Jour. Geol. Vol.2, p.708-724~~
pp.837-851

16 ~~(2)~~ Merrill J.H. Principlesof Rock Weathering, Jour. Geol. Vol. 4, 1895 P.850

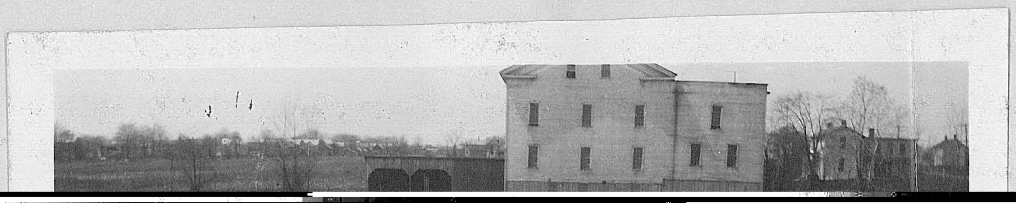
17 ~~(3)~~ Campbell M.R. - Drainage Modifications and their Interpretation. Jour. Geol. 4, P.570

Vol

PLATE I

Sandusky River at Tiffin--showing low limestone river banks

Sandusky River at Tiffin showing local rapids in the stream bed



THE LOWER COURSE OF THE VALLEY OF SANDUSKY RIVER

At Ballville the Sandusky River flows east and makes a feeble bend to the north flowing N. N. E. through Fremont. On the west side of the river a quarter of a mile north of the Ballville Dam there is an abandoned rock channel runnigg at right angles to the present stream. A half mile north this channel turns east and is entered by the main valley. The main valley enters drift at the point where the abandoned channel leaves it as far as the centre of Fremont where limestone banks are again seen. A group of small ravines on the east side of the valley in this drift area point to the possibility of a valley having been cut out of the drift-filled depression before the main stream reached it. Thus the main stream at one time flowes in the abandoned channel which made a northward turn, off from the present main stream which up to this point has a rock channel of approximately the same width as that of the abandoned channel. Undercutting occursed on the turn until the main stream reached the previoysly excavated drift area. See adjoining figure

When the main stream reached this valley it left its old rock channel high and dry. The rock hill could not have simply been an isolated hill or else the upper end of the abandoned channel would not be narrower than the lower end. See plate 11

At the Lake Shore and Michigan Southern ~~R.R.~~ railroad Bridge there is a broad, ~~and~~ even flood plain on the east side of the stream. Limestone banks are soon lost sight of. North of Fremont the river makes long meanders and its banks are low and composed of till beneath and lake clay above; finally nearer the lake only lake clay is seen in the banks. The meanders are even more gently curving, the river banks are low and there is much adjacent marshy land. Similar marshy conditions occur at mouths of all streams entering Sandusky Bay. This shows an uptilting of the lake

basin to the northeast and a drowning of the mouths of the rivers entering it from the southwest.

FIGURE I

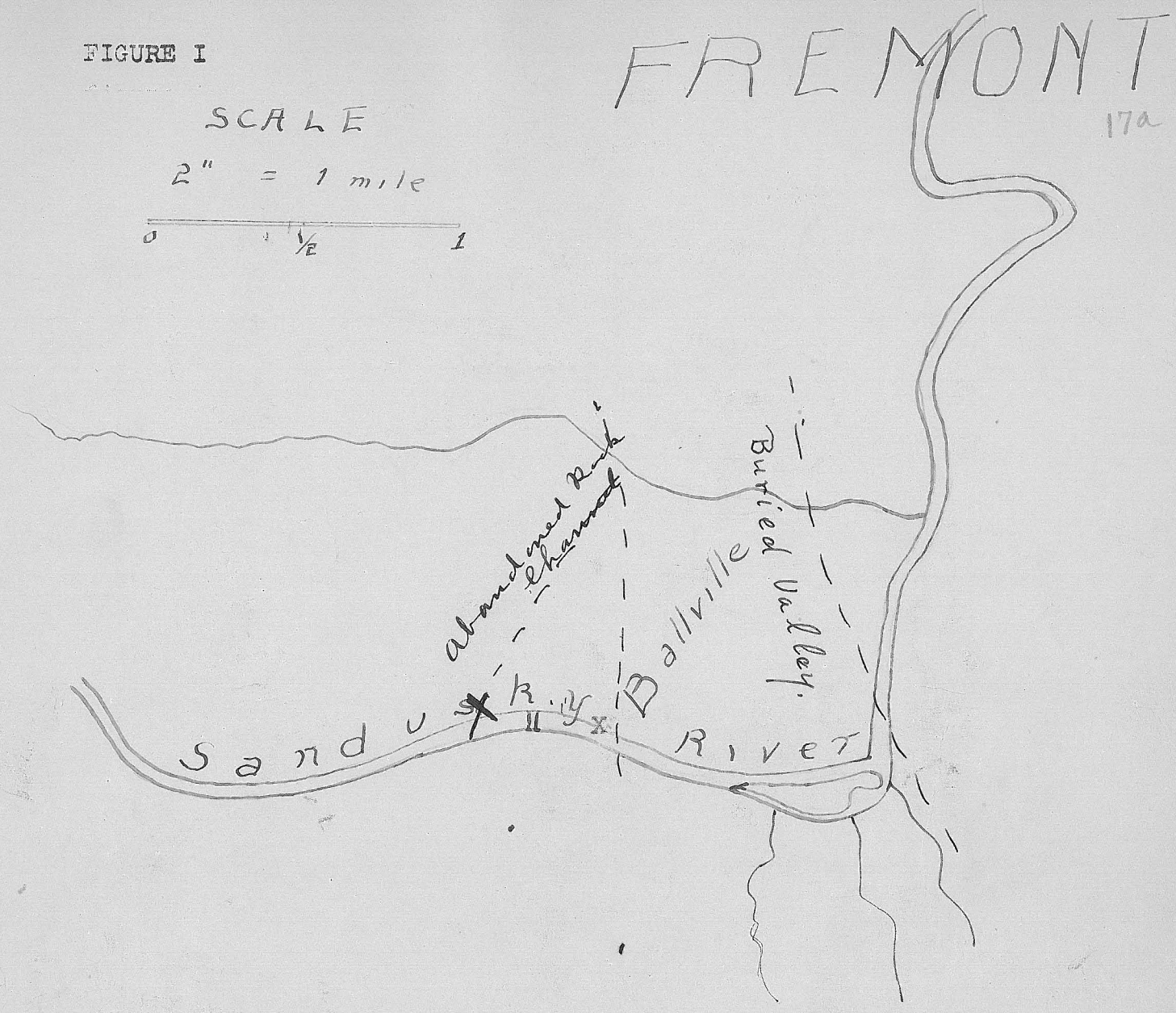


Figure showing the abandoned channel at Ballville. and laterals on the east side of the present stream which had reexcavated the preglacial depression before the stream in the rock channel cut through at X

PLATE II

Sandusky River scene four miles north of Tiffin

Local bowing of Monroe limestone strata in the stream bed of Sandusky River at the bridge two miles south of Fremont.

Abandoned Rock channel at Belleville.

Huron Valley General.— The sources of Huron River lie on the Till Plains and moraines south and east of Willard. Two main streams are thus built up, West Branch and East Branch. The river drains Huron and part of Erie counties. ~~It~~ Its course flow~~s~~ on the Till Plains to the Maumee Beach at Monroeville and ~~M~~Norwalk then on Lake Plains to Huron and Lake Erie. The branches unite about two miles above Milan.

GENERAL DESCRIPTION OF THE VALLEY OF HURON RIVER

The West Branch of Huron River rises on the Till Plain at an altitude of 1,060ft. southwest of Greenwich, Ripley Township near the south boundary of Huron County. The East Branch rises in the southern part of the County in Fairfield Township a little southeast of Fairfield at an altitude of 952ft. The river drains all of Huron and part of Erie county to the northwest. The area is till and lake plain underlain by Huron shale.

The West Branch from its source to the lake has a course of nearly fifty miles while the length of the East Branch is nearly thirty miles. The East Branch flows northwest and the West Branch flows northeast until they meet some thirteen miles south of Lake Erie about a mile and a half southwest of the town of Milan. In the upper courses the branches have low banks and narrow valleys while near the fork the courses are meandering. The terraces are better marked above the fork while below the fork they are trimmed off and the valley ~~side~~ is more or less gorgelike. Near the mouth the terraces merge into an even, gentle valley slope, no well marked terraces being found. The mouth is slightly drowned as shown by marshy inlets.

The tributaries of the West Branch are Marsh Run, entering from the west near New Haven, Slates Run entering a little south of Monroeville and Seymour Creek entering two miles south of the fork. The tributaries of the East Branch entering from the east are Cole Creek, coming in two miles southwest of Norwalk and other small creeks.

GENERAL DESCRIPTION OF THE HURON RIVER VALLEY

The upper courses of Huron River are cut through glacial drift; The banks are low and the valley sides are gracefully rounding; here and there are steep river banks dur to local heaping of drift. Boulders and small pebbles are numerous. A mile south of Monroeville the West Branch cuts down into Huron Shale while the East Branch does not reach shale until two miles south of the fork. Where the river is in shale, steep banks are found and clay ironstone concretions ~~with pyrite and celestite~~ stand out in the river bed like tree stumps.

~~Below Milan the gorge-like character of the valley wanes and the valley broadens out.~~ The upper course of the river represents all the features of drift erosion such as hummocky terraces, uneven banks, landslides, alluvial fans, sand bars and abandoned river channels. The middle course of the river presents youthful features such as trimmed-off terraces, gorges, rapids, large meanders, incipient cut-offs, sand bars, and spits, as well as other features found in the normal erosion and denudation of sedimentary rock. The lower course of Huron River presents features of advanced youth such as a semi-base-leveled terrace slope where the lines of individual terrace fronts are obliterated, and long and gentle curves in the course of the river. ~~and drowning of the mouth.~~ At the lake the river flows parallel the Lake Erie for three quarters of a mile before breaking through the lake beach.

1 Read M. C. Ohio Geol. Surv. 1878 v. 3 p290

DESCRIPTION OF THE VALLEY OF THE WEST BRANCH OF HURON RIVER FROM GREENWICH TO MONROEVILLE

Huron Valley in Detail

East of Plymouth West Branch

At Greenwich the stream wanders aimlessly westward upon the till, and has carved out for itself the shallowest of valleys. Near Plymouth it enters the Ft Wayne moraine and has hilly topography on each side. ~~The stream takes a very irregular course west to Plymouth on the level till plain;~~

From there the course of the stream is north. ~~On the east side of the valley there is a group of isolated knolls probably hills in the Fort Wayne moraine.~~ Between New Haven and Graham School the valley is V-shaped and distinctly in infancy. ~~with hummocky tops on the valley sides.~~

At Graham School it enters the big Defiance moraine and though very crooked manages to remain in the moraine until within about 4 miles of Monroeville ~~From Graham School to the road leading to School No. 7, the~~ The river cuts deeper into the drift, ~~The river~~ winds back and forth into a northwest direction in its wide drift valley as far as Greenfield School, ~~where it~~ and there turns north between drift bluffs ~~valley sides~~ which become less and less prominent. In this course through moraine the stream meanders well and has a typical flood plain. Finally the river flows right out upon the ~~till~~ Lake plain in a straight course, except for one meander, north ~~as far as~~ Standardsburg; there for two miles to ~~the river~~ it begins cutting into Huron shale and cuts deeper and deeper into this shale so that at Monroeville a rather deep gorge has been carved.

DESCRIPTION OF THE VALLEY OF THE WEST BRANCH OF HURON RIVER FROM MONROEVILLE TO MILAN.

At ~~the~~ Monroeville ~~Dam~~ the stream begins typical meandering again ~~there is a wide floodplain on the east side of the river above which rises the valley side with gentle upper slopes.~~ This time the curves are distinctly larger than in the moraine because the stream is larger. The town is ~~Dam~~ mostly on a tongue in a meander bof. ~~In this part of the river more of the shale bluffs are on the east side.~~

A half mile to the north there is a drift-filled gorge exposed in the east side of the present gorge. ~~of the present stream.~~ Here boulders are found at the bottom of the buried valley ~~gorge~~ while its southeast side rises as a vertical bluff ~~cliff~~ of Huron shale capped with ~~buried in~~ till. A mile farther north in the Milan road there is a south facing scarp of Huron shale buried in drift which shows that this filled valley may have been three quarters of a mile wide and that its direction ~~ion~~ is probably ~~thought to be~~ northeast. Since it is so youthful a feature it is no doubt interglacial.

About two miles and a half south west of the fork the gorge deepens greatly; narrow canyons ~~gorges~~ are also developed in the laterals. There are no terraces. The main stream meanders back and forth across it gorge floor. Occasionally remnants of terraces are found locally defended by rock ledges but this is unusual. It is at this point that Seymour Creek enters the West Branch. Its deep gorge is evidence of the rapid rate at which dissection of the area ~~eerea~~ is going on.

Below the fork the stream banks become lower and the valley widens considerably, there being a high, rolling, slightly terraced valley side to the West of the Huron Road.

DESCRIPTION OF THE VALLEY OF THE EAST BRANCH OF HURON RIVER FROM NORTH FAIRFIELD TO NORWALK.

A half mile northwest of North Fairfield the East branch of Huron River divides and sends out branches one north of North Fairfield and one south of this town. These branches, streams which unite near North Fairfield to make up East Branch, have very young valleys with no ~~upper~~ terraces.. From the ~~fork mentioned~~ junction above, the course of the river lies just east of a north and south esker for about four miles. ~~Here the river flows out upon the till plain;~~ the banks are low and there are no terraces. The stream scarcely meanders at all. ~~to speak of.~~

At Macksville there are three or four terraces apparently due to normal down cutting as farther up stream they do not exist but gradually come into existence farther away from the river source. ~~At Macksville the river turns northwest flowing in that direction~~ Below Macksville for two and a half miles, ~~here~~ the terraces are broad and the banks of the river are low. The river now turns northeast, leaving the moraine and flows across the maumee shaleine and lake Plain in a ~~where drift hills are encountered and~~ V shaped valleys cut in lake clays. ~~are cut in the drift.~~ The river becomes incised, its ~~The~~ course ~~is~~ more meandering than it was farther upstream, and its scrolls of flood plain nearly developed. ~~The valley width is greater with older~~ terraces ~~farther back from the stream having rolling and hummocky tops.~~ adorn the sides of the valley and meanders are rather typical. At the highway ~~in~~ between Monroeville and Norwalk there is a broad flood plain near a meander curve. ~~on the east side of the river.~~ These valley forms ~~of apparently~~ signifying great erosion are due to the ease with which the ~~drift has~~ lake clays have been eroded and carried away.

The tops of the bluffs are strewn with glacial boulders and the outline of the top of the valley side is broken by the erosion of numerous laterals.

~~DESCRIPTION OF THE VALLEY OF THE EAST BRANCH OF HURON RIVER FROM NORWALK TO THE FORK~~

Just north of the Norwalk road there is a broad level flood plain on the east side of the stream; the valley sides are far back and have rounded and hummocky tops characteristic of erosion in drift. Cattle paths aid erosion by initiating gullies in the ~~valley side(1)~~

from the meander section

The river proceeds northward in a very ~~irregular~~ crooked course with sharp turns; there are long ~~narrow~~ islands in the stream, sand bars and newly formed tiny fans. The stream is entrenching itself. This continues to the junction with West Branch.

At the bridge a mile south of the fork shale is seen cropping out in the river banks and the valley begins to take on the appearance of a gorge; north of here the upper part of the ~~valley side~~ bluffs is hummocky and uneven ~~for~~ in spite of the fact that it is composed of ~~glacial drift~~ lake clays. while the lower part of the valley has the definite outlines of a ~~valley side~~ bluff composed of shale. ~~banks~~. This is due to the rapid erosion of many little lateral ravines in the clays.

~~A half mile south of the fork the valley turns a little to~~ the east and there is a broad flood plain on the west side of the stream. From here the valley grows narrower and a typical gorge is developed. There are a few terraces on the upper slopes protected by shale banks below.

East of the junction is a low area a half mile wide separated from the river by a ridge. The low strip is open at the west to East Branch and at the other end to Huron River. East Branch formerly took a turn through this area entering Huron at least a mile below the present mouth. Near the present mouth I am raised meander came close to ~~the main stream~~ West Branch and by lateral planation the ridge between was finally cut out and the present courses established and this low area became

~~1 Merrill J. H. Principles of Rock Weathering~~

~~Jour Geol Vol 4 1896 p 855~~

"A" Lower Course of Huron River refer back.

~~THE LOWER COURSE OF THE VALLEY OF HURON RIVER~~

North of Milan the rolling gently sloping valley ~~sides~~ walls continue; the stream makes wider meanders on more marshy floodplains; river banks become lower still and terrace fronts become obliterated. Finally at the Lake Shore Road Bridge at Huron, terrace fronts are no longer seen, there only remains a gradual slope from the lake plain above to the water course below. (over) ~~This is characteristic of advanced youth.~~ The river mouth is drowned as shown by ponding back of lake water for a half mile in the river. ~~Huron river flows for three quarters of a mile parallel with the Lake Beach. The beach has offered an obstruction to the river which must follow it until a weak place is found where it can break through.(1)~~ A sand bar has been thrown up by the waves part way across the mouth of the river. This is a normal thing when a rather weak stream flows into a lake with much energy (18)

(18) Goldthwait J.W. Abandoned Shorelines of Eastern Wisconsin
Wisc. Geol. Surv. Bull No. 17 p48,49

GENERAL DESCRIPTION OF THE VALLEY OF VERMILION RIVER

The Vermilion River rises from Savannah Lake at an altitude of 1,020 ft., in an old valley well plugged with drift, ~~the till plain in the northwestern part of Ashland County~~. The upper course drains Till while the lower course drains Lake Plains, the river crossing the Maumee beach about six miles from the lake. The area drained is a strip six to eight miles wide from the centre of Ashland ~~County~~ through Huron ~~County~~ and the western part of Lorain County to Lake Erie. ~~This area~~ It is about to be pirated (19) by the West Branch of Black River seven miles southwest of Wellington.

From its source Vermilion River takes a meandering course northeast some fifty miles of water way to Lake Erie. In the upper part the river course is straighter near the fork.

The important tributaries of Vermilion River are on its east side although the river gathers the drainage for the entire basin. The East Branch rises in several heads around New London and flows northeast in a circuitous course for nine miles to a point two and a half miles north of Clarksfield where it enters

[redacted]

Vermilion Valley in Detail.

~~DESCRIPTION OF THE VALLEY OF VERMILION RIVER FROM SAVANNAH LAKE TO THE CLARKSFIELD BRIDGE.~~

Vermilion river drains the north end of Savannah Lake; in a large old rock valley, but the course of the stream is northwest between low lying valley slopes. The drift is very hummocky and marshy in places. There are few laterals in this part of the valley. About two miles southeast of Fitchville the river ~~banks~~ bluffs become higher, ~~From~~ Fitchville the river meanders in short loops in a northeast direction to the Lake. Near Clarksfield there are two, and in places three terraces along the ~~valley sides~~ bluffs. The valley floor is relatively narrow.

Three or four miles southwest of New London the old valley becomes wholly obscured by the drift because the stream has cut more deeply into the drift. At Fitchville it crosses the Defiance moraine and runs here nearly to the

~~DESCRIPTION OF THE VALLEY OF THE VERMILION RIVER FROM CLARKSFIELD TO WAKEMAN~~

Just east of Clarksfield ~~there is a broad fertile~~ the river crowds close to the west side leaving a broad fertile flood plain west ~~of the river~~ and ~~the opposite valley side~~ a steep bluff on the east, ~~is moderately steep;~~ the upper slopes are rounded erosion forms in drift. Farther down the slopes, fans and hummocks are built ~~are carved~~ from the easily eroded drift. ~~The river makes many irregular bends keeping in a northeasterly direction as far as the road leading to Todd School. Just south of this road~~ Below the mouth of East Branch the terrace on the east side of the stream furnishes grounds for a sightly residence. ~~North of the road the valley narrows for a quarter of a mile, then widens on the west side where the valley sides~~ Two large meanders and a series of small ones occur between here and Wakeman. When the valley widens, the bluff is far back from the river on one side, while on the opposite side ~~of the river the valley side~~ the river usually undercuts consists of rather steep drift banks.

From this point the valley narrows; the river has a twisting and irregular course. There are many glacial bowlders in the stream bed and the drift banks are very hummocky. The river has incised its bed. This process can be seen with many of the laterals also.

A half mile south of Wakeman the valley opens out on the east side of the stream where there is a level ~~fidda~~ plain while on the opposite side of the stream steep bluffs of shale and drift are to be seen. (see Plate III)

PLATE III

Vermilion River just north of the Todd School Road bridge, steep drift slopes can be seen in the back ground.

Wide Floodplain in Vermilion River valley just south of Wakeman

Wide valley of advanced youth in the East Fork of Vermilion River a half mile northwest of Kipton

Valley of the East Fork of Vermilion River two miles northwest of Kipton

~~DESCRIPTION OF THE LOWER COURSE OF VERMILION RIVER~~

At the highway bridge at Wakeman ~~gray Ohio~~ shale is seen in the river bed and part way up the banks and thus here begins the rock's influence in the form of the valley. North of the dam the river valley deepens with some step terracing in the valley sides. A half mile north of Wakeman there are many small laterals which dissect the valley sides leaving rounded promontories between them.

Three miles north of Wakeman, Berea sandstone crops out in the river bed and here the valley is steep sided and narrow. Two and a half miles south of Birmingham the river cuts into Bedford shale which makes loose and crumbly banks; a half mile farther north the river reaches Cleveland shale which makes steep valley sides; great flat ledges of this fissile shale crop out in the river bed, which at low water ~~make large~~ is a hard rock flat.

From this point to within three miles of Lake Erie Vermilion River meanders on a broad level flood plain hemmed in by gorge ~~sides~~ walls 70-80 ft. high and composed of blue, black and red shales. (20) As down cutting has gone on, many terraces have been made and the earlier ~~terraces~~ ones have been trimmed off (21).

Two miles south of Birmingham the East Fork enters the river from the south east in a similar deep gorge; the East Fork rises near Kipton where two little creeks converge; their valleys are wide and spacious because of the ease with which the drift is eroded. Chance Creek enters the main stream three and a half miles farther to the northeast; it is a boisterous stream with a rugged and rocky bed. The sides of its gorge are steep and cragged because carved in more resistant shale. ~~(5)~~

~~a mile from Lake Erie Vermilion River~~

Just north of the mouth of Change Creek, ~~there is~~ stands an isolated hill in the east side of the valley ~~bottom~~, which is the result of the cut-off meander, ~~being~~ entrenched. Below this cut off meander is another larger one not yet cut off. It has not yet been able to begin its migration down valley but twists and turns in its own area gradually widening the valley.

From the mouth of Chance Creek to about a mile from Lake Erie Vermilion River takes a northwest course gorge sides which decrease in height as the lake is approached three quarters of a mile to avoid the lake ridge. The Lake waters are ponded back in the lower part of the river as seen by its marshy flood plain.

From Bagley down to the lake the bluffs decrease in height because the slope of the land is steeper than the present grade of the stream. Many meanders have developed and slipped along down the valley flaming the bluffs until they are nearly straight, parallel, walls bounding the meander belt. Small terraces occasionally occur.

20 Henry Dewey, Origin of some River Gorges in Cornwall

Q. J. G. S. Vol 72 p 64-66

21. Fisher W. D. Terraces of the West River Proc. Boston Sec.

Nat. Hist. Vol 33 1906 p

~~3 Henry Dewey, Origin of some River Gorges in Cornwall~~

~~Q. J. G. S. Vol 72 p 66~~

The swampy condition of the lower mile or two testifies against the recent tilting of the Erie Basin; and the sand bar across the mouth of the valley, almost shutting the river out, is evidence of the excess of power of the lake waves over the strength of stream current.

GENERAL DESCRIPTION OF THE VALLEY OF BLACK RIVER

The West Branch of Black River rises, on the surface of the till plain seven miles southwest of Wellington at an altitude of about 1,000 ft, in the southwestern part of Lorain County; many sources lie upon the north side of the Defiance Moraine. The East Branch rises on the south slope of the moraine at about the same altitude in Harrisville Township Medina County; The upper courses drain till plain of the northeastern part of Ashland County, the western part of Medina County and the southern part of Lorain County, while the lower courses drain the till and lake plains of the central and northern part of Lorain County. These both Branches converge toward each other in a northerly direction and meet about nine miles south of Lake Erie. (1)

The upper courses are characterized by wide submature valleys because of the ease with which the drift is eroded; and in some places by channels only, valleys not having been excavated yet. The middle courses are straighter with narrower valleys due to the resistance of the Berea sandstone and the lower course is characterized by youthful features such as a winding gorge and many terraces.

Elk Creek rises two miles west of Lagrange, flows four miles north entering the West Branch of Black River four miles southeast of Oberlin. Wellington Creek rises a little south of Wellington and enters the West Branch of Black River three and a half miles south of Oberlin.

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22 Newberry J. S. Ohio Geol. Surv. 1878 v 2 pp 206-208

~~Charley Hunt Creek rises west of Wellington and enters the West Branch of Black River two miles north of Wellington.~~ Plum Creek rises three miles southwest of Oberlin, ~~and~~ flows ~~for a distance of~~ nine miles ~~in a~~ northeasterly ~~direction~~ and enters the West Branch ~~of Black River~~ five miles east of Oberlin.

Coon Creek enters the East Branch ~~of Black River~~ from the west, eight miles northwest of Lodi. On the east side the important tributaries are Crow Creek entering eight miles and Salt Creek entering four miles south of Grafton. The more important tributaries are on the west side of the West Branch and on the east side of the East Branch showing convergence of drainage toward the ~~Black River~~ Elyria embayment ~~at Elyria~~ of the Maumee and Whittlesey shorelines.

The gradient of the lower course of the river is lower ~~Greater~~ than that of either branch showing that the lower course ~~is the scene of~~ has made greater progress. ~~of~~ by ~~erosion~~. The East Branch may be considered a little older than the West Branch ~~as evidenced by~~ as suggested by its lower gradient.

There is a temporary baselevel just south of the Maumee Lake ridge at Laporte (23) in the valley of the East Branch as can be seen by its broad valley, wide meanders and low river banks. Just south of the present falls of both branches at Elyria is a second temporary baselevel as seen by the low river banks of Berea sandstone and lake clays. This baselevel was made with reference to the level of Lake Whittlesey. A third temporary baselevel cannot be found as the valley has been cut down to such a wide and deep gorge that all evidences of greater age near the Warren Lake

level have been obliterated.

The West Branch of Black River works in drift until it reaches Berea sandstone four miles south of Elyria. The East Branch cuts into Cuyahoga sandstone and sandy shales at Lodi, and farther north into drift; a few miles south of Grafton Berea sandstone is reached which serves for river bed as far as Elyria. From Elyria north with the exception of several drift filled depressions Black River cuts into Berea Sandstone for two miles; then the Bedford and Ohio shales are reached. These shales are exposed in its deep gorge to the mouth of the river. The depth of the gorge decreases as the lake is approached due to the decreasing altitude of the Lake Plain. The lower course has many meanders with side channels and cut-offs. Many of the bottoms near the lake are drowned by lake waters showing the southwest downtilting of the lake basin. The river shows parallelism near its mouth like that of Vermilion and Huron rivers.

23
1 Carney Frank Abandoned Shorelines of the Oberlin Quadrangle; Sci. Lab. Denison University 1910 p 102

Valley of Black River in Detail.

~~DESCRIPTION OF THE VALLEY OF THE WEST BRANCH OF BLACK RIVER FROM NEAR ITS SOURCE TO THE WELLINGTON ROAD.~~

~~At Day School house the~~ East and west of Rochester, two tributaries of West Branch of Black River unite and continue to ~~is a small creek which~~ flow ~~north, then northeast~~ in a gradually broadening and deepening V-shaped valley. There are no large terraces but many interlacing small ones, ~~The~~ other ~~are~~ laterals converge northeast. ~~There are~~ and no true meanders, only irregular and abrupt turns characteristic of drift erosion. The valley at the main road west of Wellington ~~road~~ has a submature appearance due to the ease with which the drift is eroded. A fringe of tributaries has roughened the topography for a half mile each side of the stream.

~~DESCRIPTION OF THE VALLEY OF THE WEST BRANCH OF BLACK RIVER FROM THE WELLINGTON ROAD TO THE FORK AT ELYRIA.~~

~~The West Branch of Black River crosses the east and west highway three miles west of Wellington north of which~~ Beyond this road to Wellington the valley becomes three quarters of a mile wide. The bluffs ~~valley sides~~ have Hogarth curves(24) There are many short meanders which are entrenching themselves as evidence of the ~~repeated~~ recession of Lake Erie. The floodplains are cut up with side channels, meander cut-offs and other signs of ~~pre-~~ aging ~~cessive dissection~~. In some ~~valley sides~~ places uplands are very rough and hummocky ~~while~~ and where local heaping of the drift has occurred the valley grows narrower between steep drift hills.

24 Hicks L. E. Some Elements of Land Sculpture
G. S. A. Bull. v. 4 1893 pp 133-146

over. back of p 33

by West Branch

As the stream descends the Till Plain its ~~valley~~ bluffs become lower and ~~it grows~~ it seems to merge directly upon the Till Plain. ~~where the tributaries are numerous~~ similar and has its shallowest part west and south west of Wellington. ~~the intervening areas are swampy.~~ ~~This occurs about two miles below the Wellington-Oberlin~~ road, ~~reached~~ a true meandering habit is adopted, but meanders are very small to be commensurate with the small size of the stream. ~~Entering the Oberlin road where the valley lines are very~~ Wellington Creek resembles the other branches very much. ~~Deepened due to the surface erosion of drift.~~ The floodplain comes a true meandering stream about 2 miles above its mouth. ~~on the south side of the stream is wide and level.~~

~~Above the Wellington-Oberlin and the West Branch roads~~ ~~valley, but~~ about at this place the valley becomes distinctly ~~in a shallow drift sided valley; there are numerous little broader~~ a well developed flood plain ~~begins and extends from it wider~~. Five miles east of Oberlin where the stream turns north ~~three~~ three terraces occurs, the highest being an eighth of a mile wide, and the two lower ones only a few feet in width. The high terrace or old floodplain was made with reference to a former temporary base level and now the stream is entrenching itself in its old bed (25 x).

For about 5 miles below the mouth of Wellington Creek many good (over)

At the mouth of Plum Creek a mile ~~above~~ ~~there~~ terraces is seen some of which coalesce right at the mouth itself. Several other terraces occur up Plum creek for it has meanders ~~above~~ ~~there the river flows northeast with a very~~ well much of the way from Oberlin down. About 3 miles above the junction ~~winding course for five miles. From here on~~ the river encounters the Berea Sandstone and is straighter in its course. ~~and the rivers bed consists of Berea sandstone.~~

At Elyria the stream makes a wide meander west and north then turns east and follows the south side of its whole course here being entrenched in the sandstone the Whittlesey Lake ridges until it meets the East Branch.

25 x Carney Frank The Abandoned Shorelines of the Bull Oberlin Quadrangle. Bul. Lab. Denison University 1910 p 104

~~DESCRIPTION OF THE VALLEY OF THE EAST FORK ONE OF BLACK RIVER FROM LODI TO RIVER CORNERS~~

The East Branch of Black River heads back in marshy areas just south of Lodi while the East Fork one of its tributaries rises a mile north of Chatham, flows south and meets the East Branch just north of Lodi where Cuyahoga encounters and is influenced much more by bed rock than the West Branch. shale ~~banks are found along the river sides~~. The ~~source~~ of ~~the East Fork is a northern outlier of the Defiance moraine~~.

From Lodi the East Branch flows northwest in a circuitous course with ~~very hummocky valley sides~~ dissected bluffs and narrow floodplains for about three miles. ~~where~~ Then the valley opens out, and floodplains are broader, and meanders are wider and more numerous. Between here and Grafton meanders and cutoffs can be found in almost every stage.

Three miles southeast of River Corners some of the meanders have almost cut themselves off; one meander has built out a ~~(1)~~ 26 sand bar cutting off its own channel and now has cut a channel beyond the newly made sandbar next to the ~~valley side~~ bluff. Sand islands are common in this section. Another meander is closing up its meander curve with a sandbar while it continues to flow in the cut-off. In another place the meander loop has been abandoned and the stream now flows in the cutoff; the abandoned loop is easily made out by a line of trees which border this abandoned channel. At one place a fallen tree has dammed up the meander curve and so a cutoff has been developed after which the water rose so much in the meander loop that the old channel is now being dredged out again and the main stream now flows in the meander curve.

26 Tower W. S. Developement of Cutoff Meanders
Am. Geogr. Soc. Bull. v. 36 1904 pp589-599

In this part of the valley the bluffs are directed and rounded at the top; at the confluence of laterals small terraces are developed with here and there small alluvial fans. Here the terraces are almost always dissected and uncertain. The great width of someof the lateral valleys might indicate the tributaries to be in valleys carved before the main valley existed; but as these laterals are not continuous on opposite sides of the main stream the great width of their valleys must be laid to the ease with which the drift can be eroded. The valley sides of the laterals appear more mature, due to surface wash; all their step terraces are trimmed off whereas in the main stream lateral shifting of the stream causes step terraces to be formed. Two miles southeast of River Corners there are many islands in the stream, the meanders are entrenched and the valley is much wider.

DESCRIPTION OF THE VALLEY OF THE EAST BRANCH OF BLACK RIVER FROM RIVER CORNERS TO CRAFTON.

At River Corners Black River makes a slender loop to the northeast. On the east side there are bluffs of till twenty to thirty feet high while on the west, terraces slope back from the river. The high bluffs at River Corners appear to be two sides of a glacial knob which backs up drainage in a swamp or kettle just to the east. From the loop at River Corners the river flows straight north; here is a wide floodplain on both sides of the river. The upper terraces are rolling and dissected by laterals which have a general northward trend.

A mile north of River Corners Black River turns abruptly west flowing in a sinuous course for a mile in this direction.

Low level floodplains are found extending far back upon both sides of the stream. The river then turns north and for a mile its banks are becoming incised. At the county line the stream flows out the Till Plain again and the banks are low, no longer being incised. From here north to Penfield there are many incipient cutoff meanders and cutoffs[27] ~~meanders~~ ~~The till plain on both sides of the stream is notably level here.~~

From Penfield six miles northward the river has a winding course, ~~in a northeasterly direction.~~ its meanders become very intricate. There are sharp bluffs of till where the stream makes abrupt turns. The meanders become more and more incised. From about two miles south of Lagrange to a mile north of the Lagrange road there are three steps of terraces. The second terrace front is the most prominent showing that rejuvenation in the present formation of the third terrace front has been very recent. The terrace ~~slopes~~ tops are broad and even, and the terrace fronts are regular and ~~rounded.~~ crescentic

About a mile north of the Lagrange road the stream begins to cut its way into Berea sandstone. ~~There are no~~ Step terraces cease and the river ~~bluffs~~ bluffs are steep ~~and~~ straight and close to the stream. Dissection is well under way as ~~can be seen~~ shown by two prominent laterals coming in from both sides about three quarters of a ~~miles~~ mile southwest of Grafton. These laterals have developed little valleys in the drift. In the river itself are numerous rapids, and rectangular blocks of sandstone stand out as bold promontories at turns in the stream.

27 Tower W. S. ~~Development of Cutoff Meanders~~ ibid

~~Bull. Am Geogr. Soc. v 36 1904 pp 583-599~~

DESCRIPTION OF THE VALLEY OF THE EAST BRANCH OF BLACK RIVER FROM GRAFTON TO ELYRIA.

Just west of Grafton the Black River Valley is characterized by gently rolling slightly terraced ~~valley sides~~ bluffs. The stream flows with gentle curves in its course in a westerly direction; its ~~banks~~ bluffs are composed of alluvium above and Berea sandstone below. The river bed consists of horizontal ~~blocks~~ beds of Berea sandstone jointed into blocks. The stream has a youthful character racing over the resistant Berea sandstone like a mountain torrent.

At the Oberlin Road Bridge west of Grafton where the stream has uncovered many weathered sandstone blocks in the stream bed, ~~which are weathered brown and red and whose jointing is weathered out.~~ Here the valley sides are very regular, with even upper drift slopes. ~~From here~~ There the stream pursues a straight course northwest for two miles where the valley as a rock gorge, is very narrow. About three miles south of Laporte the valley leaves the rock and is carved in drift hence widens; and large meanders are found which represent the advanced youth of the valley at the time when the East Branch of Black River entered Lake Maumee at Laporte. Just south of Laporte the stream turns east for a mile to avoid Buttermut ridge, the Maumee shoreline. It then breaks through the ridge where a tributary enters from the east which also follows the base of the lake ridge. This tributary makes a wide bend to the south before entering the main stream; the bend may be explained by local heaping of the lake ridge sands. ~~and so correspondingly weaker contiguous parts are developed through which the stream was able to break.~~ (See Oberlin topographic maps.) ~~See accompanying figure.~~

North of Laporte the stream pursues a rather straight course to Elyria; ~~in a northwesterly direction~~; river banks are low and near together, and there are many rapids in the stream bed. Some huge sandstone blocks are exposed by undercuts. The upper valley slopes are straight, regular and gentle being composed

FIGURE II

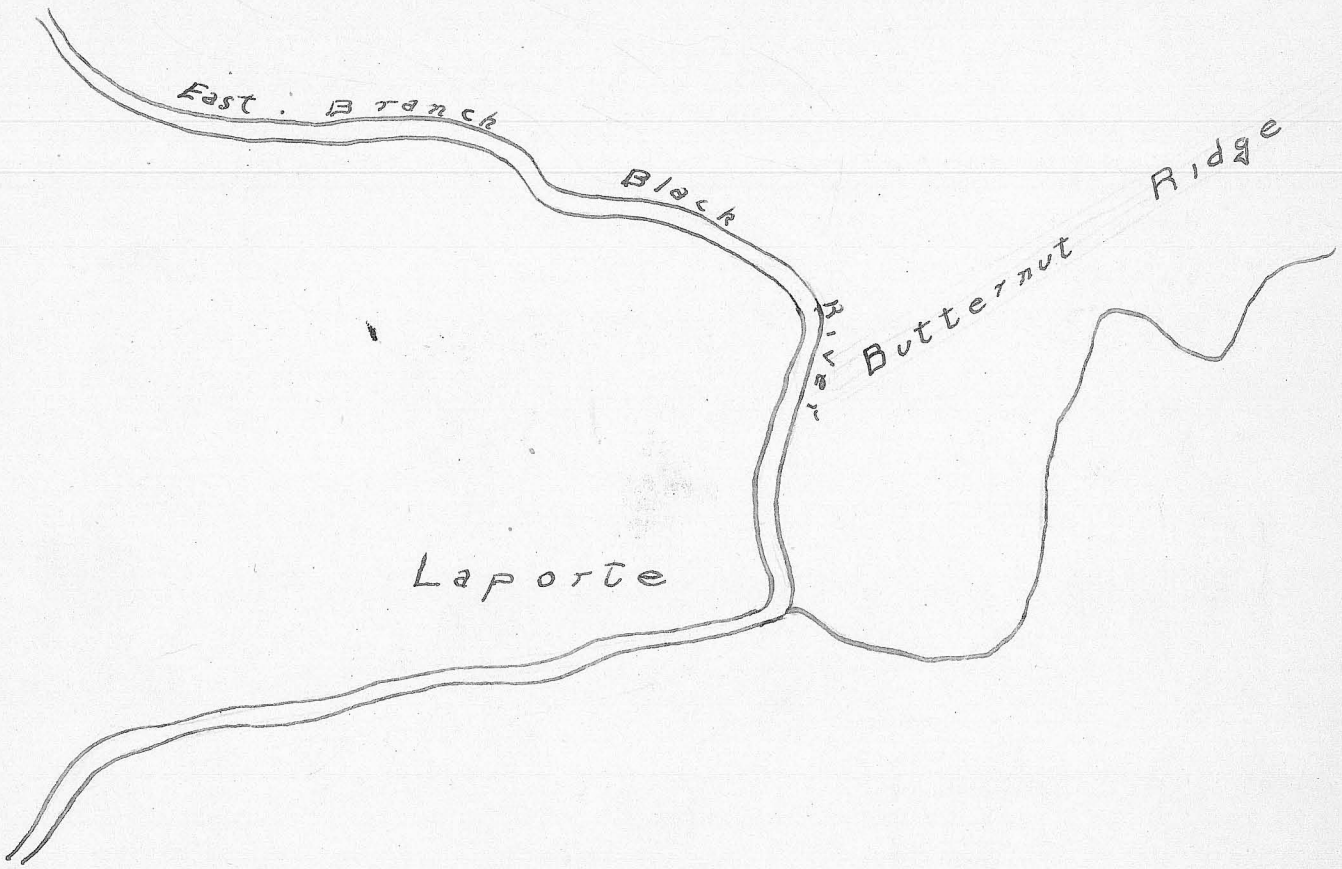


Fig. showing how the East Branch of Black river was blocked in its northerly course and followed east along the Maumee Lake Ridge for a half mile until it found a weak place where it could break through

of Maumee Lake clay.[28]

In Elyria the stream flows straight north until it makes a big meander to the east after which it turns west to avoid Middle or the Whittlesey Lake Ridge. These Elyria curves of the Branches are rather symmetrical and afford an interesting crotch for the city.

~~DESCRIPTION OF THE VALLEY OF BLACK RIVER AT ELYRIA~~

At Elyria both branches of the Black River have cut back gorges in Berea sandstone for a quarter to a third of a mile from the fork. The falls of the East Branch drop over massive ~~blocks~~ layers of gray drab Berea sandstone while the falls of the West Branch are not so great and the ledges are more broken. The gorges below the falls are very steep sided, with bold promontories of massive ~~blocks of~~ sandstone; ~~there~~ here also are ~~present~~ 'caves', potholes, undercuts, and many big sandstone boulders ~~beside the solid rock walls of the gorge~~.

A buried valley is found in Elyria recognized by the absence of rock, and presence of drift filling in many places. ~~such as~~ On both sides of the West and East Branches a little west and south of the fork respectively, and across Washington Street to the East Branch above the falls these drift fills are known, locating the old valley three times definitely the next. In the main valley a half mile north of the fork at the children's playground where the valley widens greatly, there may be another buried valley. ~~in the bluffs of the East Branch east of Washington Street and in well-borings at certain houses on Washington Street. (See plate V)~~

~~Just north of~~ Near the fork west of the main stream is an ancient river falls with a potholes and undercutting, and other youthful features. The bear's den is now nearly below this falls site. ~~(See plate IV.)~~ At the Whittlesey Lake Stage the ~~West~~ Branches of Black River emptied by ~~a~~ separate mouths. As the lake retreated to the Warren

[28] (1) Carney, Frank Abandoned Shorelines of the Oberlin Quadrangle. Bull Sci.Lab. Denison University 1910 p 102.

(29)

stage ~~its earlier river mouth became a water falls~~ the river mouth developed falls at once.[29] ~~as shown in (1) evidenced by the description given above.~~ As the West Branch turned from paralleling the old lake ridge to fall over its former mouth northward, considerable undercutting took place at the turn, too. This carried the channel toward East Branch. ~~Finally it cut into the East Branch.~~ We do not know how far the ~~gorge~~ falls of the East Branch had ~~been cut back~~ receded at that time, but the channel where cut through must have been lower than the ~~top of the abandoned falls~~ West Branch lip of the abandoned falls or else ~~it would be the East Branch that would have worked into the West Branch instead of the reverse.~~ that branch could not have been taken in; hence we assume that the falls of East Branch had retreated at least as far as the junction joint, probably not much farther.

The River which flowed north over the abandoned falls was ~~a~~ very young, ~~river~~ and did not work there a ~~very~~ long time since the valley ~~here~~ abandoned is not ~~very~~ deep, ~~being~~ but similar in character to ~~that~~ those above the present Falls in the East and West Branches. ~~both in the lowness of its banks and in the youthful features of its bed.~~ (~~See plate IV~~) There is a line of large Berea sandstone blocks across the valley one hundred yards ~~north of~~ below the ~~fork~~ present junction, ~~which marks the edge~~ of a preglacial drift-filled ~~depression~~ valley. When the lake retreated to the Warren stage the waters of both East and West Branches made waterfalls over this rock ledge, undercutting took place so that large caves were developed beneath the Falls just as are seen in the falls of the West Branch to-day. The cave of the West Branch can still be seen at the bearden. On the East Branch a tunnel was formed by undercutting or by a small trickle working its way ~~thru~~ through a crevice and enlarging the opening. This made, of the falls, a natural bridge or sandstone arch which in no very distant past fell in, as one can infer from the massive blocks in a straight line across the valley marking the site of the old arch. (~~See accompanying figure.~~)

29 (1) Dewey, Henry Origin of some River Gorges in Cornwall G.J.G.S. vol.72 p 66.

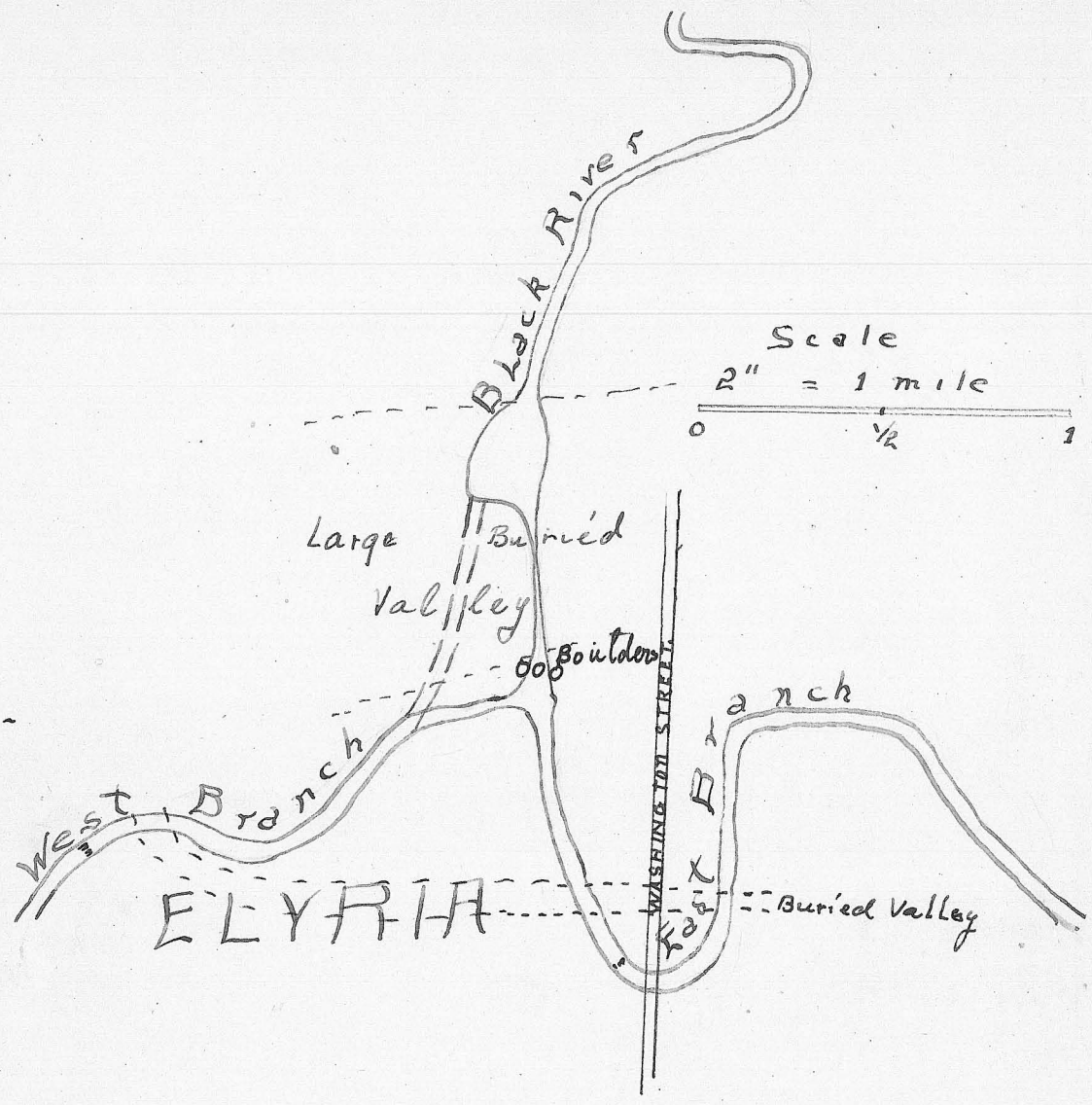


Figure showing the abandoned waterfalls in Cascade Park just northwest of the fork of the East and West Branches of Black River. Collapsed natural bridge at boulders in stream a short distance below present confluence of East and West Branches.

PLATE IV

Falls of the East Branch of Black River

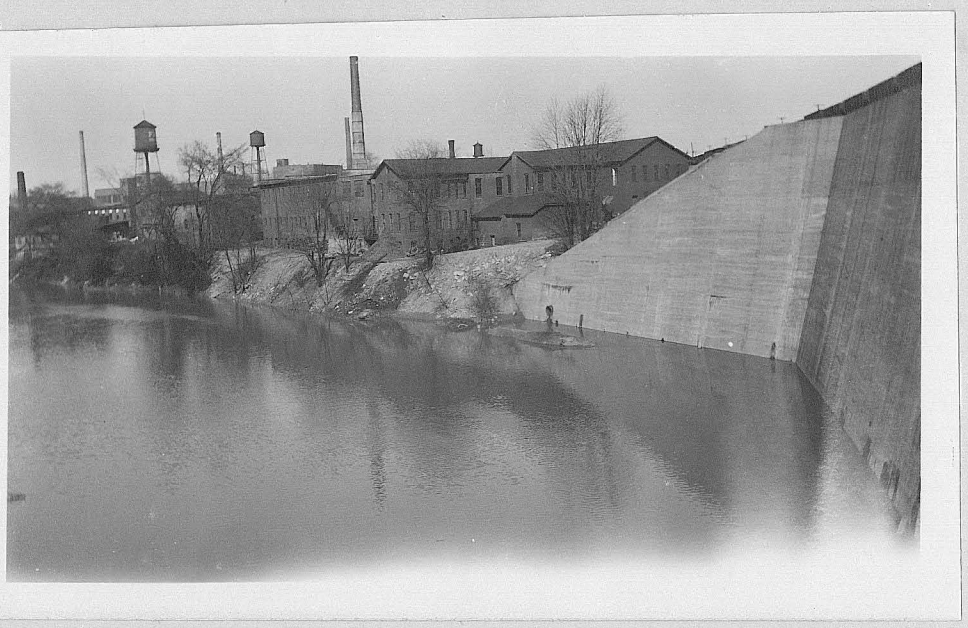
Undercutting and potholes in abandoned falls just northwest of the confluence of the East and West Branches of Black River

Falls of the West Branch of Black River

Falls of the East Branch of Black River

PLATE V

The valley of the West Branch of Black River just above the falls



The valley of the East Branch of Black River just above the falls.

North of the line of sandstone blocks the valley widens out into a large amphitheatre with hummocky, irregular, and uneven valley sides of drift. Just north of the amphitheatre sandstone ledges re-appear and the valley narrows again to a sandstone gorge, a distance of about 1 mile

~~DESCRIPTION OF THE LOWER PORTION OF BLACK RIVER VALLEY~~

(~~Two miles north of Elyria the~~ Beyond this gorge section) Black River has cut itself a ~~deep and~~ much wider gorge whose ~~cliffs~~ bluffs are from 70 to 80 ft. high. This gorge is cut in blue Ohio shale. Within the gorge the river meanders upon a level valley floor. The meandering habit persists practically all the rest of the distance to the lake. ~~Five miles north of Elyria there is a large eastward meander loop whereas the old gorge meander loop is westward, now abandoned by the stream.~~ (over)

At the Bone Mill Road bridge the shale banks are very crumbly and there are gently sloping upper terraces, above the gorge side on the west side of the valley. Farther down the valley these terraces play out and the gorge has a sharp outline at the top (1). The shale banks grow steeper the farther down stream one goes.

Three miles north of Elyria the river makes a long loop to the northeast just south of Warren Ridge; this is because the river was blocked by the lake beach when it emptied into Lake Warren (2). From here the river pursues a sinuous northerly course with a very marshy low-lying flood plain on either side of the stream. Four miles southeast of Lorain the river turns sharply to the west and takes a winding course in that direction to its mouth. There is considerable drowning near the mouth as seen by numerous marshes, and ponding back of water in side streams. The Steel company has dredged out a large turning basin for ore boats near their docks

~~(1) Dewey, Henry - Origin of some gorges in Cornwall. J. G. S. 1916 v. 72 p65~~

30 (2) Goldthwait, J. W. Abandoned Shorelines of Eastern Wisconsin, Wiss. Geol. Surv. Bull. No. 17 p 48

Land East Branch of Black River ~~bath~~ near Lodi bath

GENERAL DESCRIPTION OF ROCKY RIVER VALLEY

Rocky River is the only one of the five streams studied that really heads back in the Allegheny Plateau province, although Vermilion for a few miles below Savannah Lakes flows in a large, old, preglacial, valley.

The West Branch of Rocky River ~~rises~~ has sources in the ~~Till Plain~~ Plateau near Boneta at an altitudes of ~~1,100~~ 1200 to 1300 feet ~~Sharon Township in eastern Medina County~~. The East Branch ~~rises from the Till Plain at about the same altitude near~~ has many sources in Royalton townships and West Richfield in northwestern Summit County, some of which are over 1300 feet above sea level. The main stream begins a mile north of North Royalton and flows 8 miles southeast in an old valley of the glacier (over)

~~The area drained by Rocky River embraces the northeastern corner of~~ Medina County, the northwestern part of Summit County, and a belt through the center of Cuyahoga County to Lake Erie. The river drains Till Plain in its upper and middle courses and Lake Plain in its lower course.

Rocky River exhibits the phenomenon of bifurcation ~~a mile and a half southeast of the~~ just below the earliest Maumee shoreline, at Olmstead and, as was the case with Huron and Black Rivers, formerly flowed into Lake Maumee as two separate rivers. ~~Plum Creek rises ten miles south by southwest of Columbia Station and flows northeast entering the West Branch at Olmstead Falls. Baldwin Creek rises six miles southeast of Berea flows northwest and enters the East Branch at Berea.~~ The important tributaries enter from opposite sides of the drainage basin ~~indicating the center of the depression of the drainage area to be at the confluence of the East and West Branches near the old lake embayment.~~ and the adjacent sides of the Branches have few tributaries in harmony with the interpretation that the two Branches entered the lake in the same very old preglacial valley at an embayment of the lake.

The temporary baselevel of the Maumee shoreline is found recorded in a notch ~~south~~ of the falls of the East Branch, ~~more than three~~ and about two miles to the south of the fork. ~~Here are present in the valley~~ many characteristics of advanced youth ~~such as broad flood plains, wide meanders and low river banks. This baselevel would not be so far south if it were not for the presence of the soft Bedford shale, making the river bed from south,~~ The lower temporary base levels are scarcely discernible on Rocky River.

~~to just north of Berea~~, because in Berea sandstone erosion of the gorge of the lower course of the river would not be so rapid.

The river rises on the Till Plain underlain by Cuyahoga shale, then flows in drift as far as Binola where it reaches Sunbury shale. From here north to Berea its banks consist of this shale capped by alluvial gravels and drift. At Berea the river bed is composed of the hard Berea sandstone which makes the Falls just north of the town, and the gorge below them for a quarter of a mile. From here north the walls of the gorge are first composed of soft Bedford shale and then bluish gray Ohio shales as far as the river mouth. The lower course of the valley is distinguished by youthful features such as entrenched meanders, high shale banks, isolated hills, hummocky valley sides in drift, buried valleys, with islands and sand bars in the stream bed. For a half mile before the embouchure of the river its course is deflected westward parallel with the present lake ridge. Drowning of the river mouth is not noticed, possibly on account of the artificial conditions present.(1)

DESCRIPTION OF THE VALLEY ~~OF THE WEST BRANCH OF ROCKY RIVER FROM BONETA TO A MILE SOUTH OF THE FORK~~ Rocky River in Detail

West of Boneta the north side of the valley ~~is distinguished by~~ forms numerous step terraces above which rises a gentle slope northward to the top of a knob at an altitude of 1204 ft. The course of the river northwest is irregular due to the blocking effect of the drift. In this part of the course of the river laterals come in

~~(1) Newberry, J.S. Ohio Geol. Surv. 1870 v.1 pp 171-173~~

because of uneven distribution of drift over the old rock topography. Barbed tributaries do not indicate captures. from almost any direction, ~~indicating a once marshy area, perhaps a glacial kettle.~~ Terraces are few; ~~the shape of~~ the valley is ~~that of~~ a V-shape with rolling hills of drift on either side. A mile south east of the Medina-Cleveland road the flood plain widens for several miles and carries above it.

~~From the Medina road north to Abbeville the valley widens out considerably; there are broad flood plains, low river banks and~~ terraces with rounded fronts, ~~for back from the river.~~ The town of Liverpool is on a broad flood plain on the west side of the river. From here north to Hardscrabble the river meanders in an ever deepening and ever wider gorge. Its floodplain is broad and level. A half mile north of Copopa the river has incised its banks and the higher terraces are straight and regular. Between Hardscrabble and Copopa and beyond, the meanders are numerous and well developed. They have migrated freely down stream and trimmed the bluffs until this section has a marked meander belt. A miles below Hardscrabble, a meander has cut itself off to the left an isolated hill. ~~A mile~~ Westview the river begins cutting into the hard Berea sandstone and so has a valley a great deal narrower, with bluffs ~~Its valley sides are~~ steeper and straighter. There are many rock ledges protruding from the river banks; at turns in the river huge crags stick out. From here north to Olmsted Falls the gorge becomes deeper, straighter and narrower; there are no terraces for the bluffs are close to the stream ~~have been trimmed away thru the process of widening the gorge.~~ (1)

A mile and a half north of Olmsted Falls the river works its way into shale; the ~~valley sides~~ bluffs are not so steep as before because ~~and the sides of the gorge are~~ composed of crumbly shale; ~~banks~~; there are a considerable number of terraces at many points. The river continues in these black shales to the lake. Bluffs vary from strikingly youthful to submature, depending upon the time since the river has been undercutting them.

(1) Fisher, W.B. Terraces of the West River
Proc. Boston Soc. Nat. Hist. Vol. 33, 1906 p

DESCRIPTION OF THE VALLEY OF THE WEST BRANCH OF ROCKY RIVER FROM A POINT A MILE SOUTH OF THE FORK AND A DISCUSSION OF THE ISOLATED HILLS JUST NORTH OF THE FORK

A mile south of Cedar Point where the two branches now unite, the valley of the West Branch ~~of Rocky River~~ has steep gorge-like sides; there are few terraces. The ~~valley sides~~ bluffs do not consist of precipitous shale banks because the shale is so crumbly that steep slopes of talus ~~have been formed. There are~~ no par. some large laterals ~~which~~ through headward erosion, have cut their way back into the shale and made deep ravines, ~~in the~~ for valley sides. In the flood plain are often found abandoned channels littered with rock debris as evidence of recent floods.

~~Here the~~ Such laterals are more numerous on the west side of the valley showing the convergence of drainage toward the Rocky River embayment. The laterals have upper rounded promontories between them and tiny valley systems all their own as evidence of progressive dissection of the area. The main stream is very active due to the high gradient ~~wh~~ which is more than ten feet per mile in this part of the river.

Immediately northeast of Olmsted there are two isolated hills which are a quarter of a mile in length and perhaps a little less than that in width; their long axes are north east. (See Berea Topographic ~~See plate VI~~) The East and West Branches of Rocky River now meet at ~~north of~~ Cedar Point; a sharp cusp-line bluff of bluish gray shale. At one time the two branches of Rocky River met just north of the north isolated hill ~~(see figure)~~; This may be seen by the relatively more mature appearance of the valley to the northwest of North Hill than the present valley of the West Branch just west of Cedar Point. It may be shown also that the branches met here before they met just east of the south hill because the valley

PLATE VI

Looking east- valley north of the north isolated hill in Rocky River gorge just north of Cedar Point

Looking east; the north isolated hill, north of Cedar Point in Rocky River valley

FIGURE IV

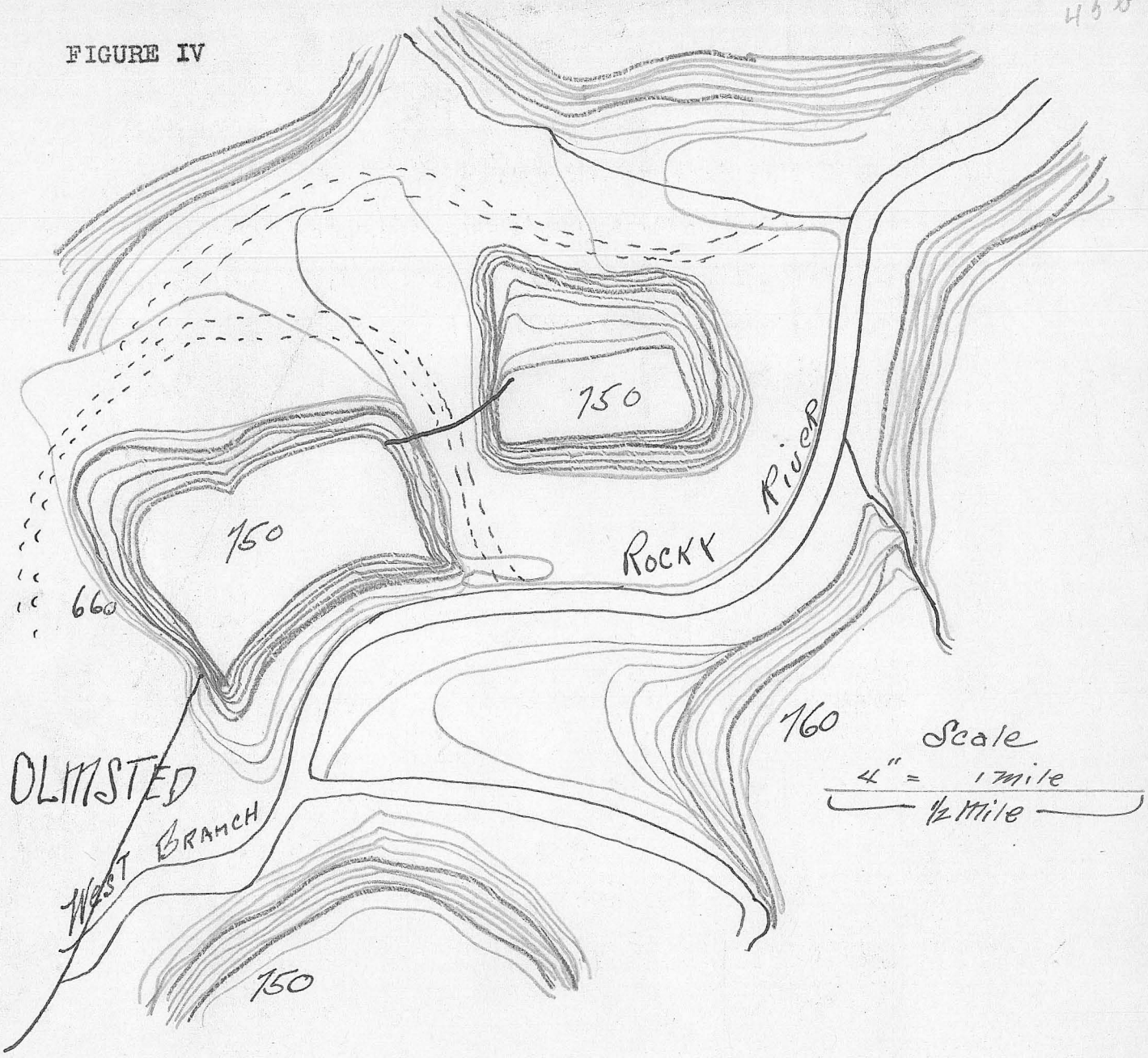


Figure showing the isolated hills in Rocky River valley just north of Cedar Point; dotted lines show the direction of former courses of the West Branch of Rocky River and solid lines between the hills show the outside curves which subsequently were undercut. Pencil lines are only approximate contours

north of the north hill has a floor a few feet higher than the floor of the valley east of the south hill, but sloping down stream; and the ~~valley sides~~ bluffs are more mature in the former valley than in the latter.

It may be seen that the West Branch flowed south in the valley east of the south hill and that the East Branch did not flow north in this valley because the valley northwest of the north hill is a few feet higher than the valley east of the south hill. ~~(See accompanying figure.)~~

The making of the valley ~~east of~~ between the ~~south~~ hills may be explained by undercutting of ~~the West~~ both Branches as they swung toward each other as ~~can be seen by the outside curve that an imaginary line would make drawn across the valley from the corners of the two hills and by headward erosion by a lateral from the East Branch. The lateral entering the valley from the west, north of the north hill is an example. The origin of the valley where the streams now meet may be explained by under~~ until they cut through and allowed West Branch to enter the other. It then followed East Branch and abandoned its course around north hill because East Branch had the lower valley floor. In a similar way meander curves in the Branches undercutting of both branches on the outside of their respective curves cut toward each other until they met between Cedar Point and South hill. West Branch went into East as before because it there had a lower course. ~~which also explains the origin of the cusp-like point just south of their confluence.~~ Examine the bluffs of the valleys and sides of the hills to see how their curves and relative steepness all conspire to support this explanation for the hills.

~~DESCRIPTION OF THE VALLEY OF THE EAST BRANCH OF ROCKY RIVER FROM WEST RICHFIELD TO THREE MILES SOUTH OF BRECK~~

~~Northwest of West Richfield the~~ East Branch of Rocky River ~~flows south on a small creek in a narrow, shallow, evenly sloping valley. There are~~ has no terraces and the ~~valley sides~~ bluffs merge imperceptably ~~with the till plain~~ into the upland slopes above. Probably the stream has not greatly modified the valley since the glaciers left it.

West of West Richfield the valley deepens and has in its lower part a steeper V-shaped profile. The river flows south here to ~~avoid a~~ conform to pre-glacial rock topography which is well mantled with drift.

in its upper five miles

In southeast Huntsley township
~~string of moraine hills;~~ it turns west and northwest around the base
rock hill and
of a ~~glacial knob where it~~ enters a preglacial valley which it follows
nearly to Berea. It usually exposes drift but occasionally encounters rock.
~~as far as Strongsville township.~~ The stream pursues a northwest course
drift-
in an ever broadening valley with even, gentle upper slopes, the mantled
bluffs of the preglacial rock valley. This old valley leads east of
the town of Berea and is occupied by Abrams swamp & creek to the Big Four tracks.
Near the west side of the Cleveland sheet there are several (over)
laterals rather close together, on both sides of the stream indicating
perhaps the drainage of a former glacial swamp. Two miles southeast of
Bihola there are several laterals which radiate from the top of the
Till Plain south of the river. The slopes of the valley sides between
the laterals are gently rounding. Just north of Strongsville the valley
is unusually wide showing the presence of the drift buried valley. 31
In this section to Berea the stream has many small meanders
which have migrated down stream planing off the valley walls and widening the flood-
~~From here the valley widens northwestward; the stream~~ plain.
~~meanders on a flat alluvial valley floor and the valley flies are~~
bluffs
~~moderately steep and are far back from the stream.~~ The stream is working
~~cuts~~ in drift and Cuyahoga shales.
~~into the alluvium and Cuyahoga shales.~~

31
32) Leverett, Frank Glacial Formations of Erie and Ohio Basins
Monog. 41 U.S.G.S. p 617

Newberry, J.S. Geological Survey of Ohio, Vol 1 p 171 and 172
Through Berea the Branch is in a rocks gorge of Berea
sandstone, narrow, rugged, youthful, and much defaced by quarrying
~~direction.~~ (south of town.) operations
~~town~~ ~~DESCRIPTION OF THE VALLEY OF THE EAST BRANCH OF ROCKY~~

~~RIVER FROM THREE MILES SOUTH OF BEREA TO BEREA~~

~~The Rocky River is found some three or four miles south~~
~~of Berea to be meandering upon a broad floodplain more than a half~~
~~mile in width; the river is working in alluvial clay and its banks~~
~~are not over five feet high.~~ There are numerous back channels, flood
curves
channels and ~~laterals~~ with incipient cut-offs. Some of the meander

loops are very short and turn back upon themselves around to neat meander tongues. The flood plain is very level. ~~The valley side also back from the floodplain is moderately steep but not so steep as the newly undercut valley sides; this illustrates the smoothing effect of surface erosion.~~ return to p 47

For two miles Baldwin Creek parallels the East Branch of Rocky River and both have wide submature valleys so that it is difficult to determine which is the older of the two. Baldwin valley floor is noticably flat where it is crossed by the Cleveland and Southwestern R. R. Here its valley side is steep with a rounding top. Both streams are cutting very rapidly into the bed rock as well as broadening their valleys. This latter can be seen by fresh fragments of clay sod just recently fallen from the top of the river bank. The bluffs of both valleys are rolling and undulating. The Till Plain between the two valleys widens into a peninsula a mile and a half south of the town of Berea.

Where the road crosses Baldwin Creek in its westward course just before entering the East Branch of Rocky River any outcrop of "black rock" as the inhabitants term it, or the black Cunbury shale is overlain by a high bluff of clay. The clay is a stratified clay like that found in river banks and contains numerous water worn pebbles. It is probably a mixture of lake clay and glacial drift worked over by the river into alluvial deposits.

The valley near the town of Berea is much defaced due to extensive quarrying operations in connection with the removal of Berea sandstone. At the bridge near the square the stream has cut down through Berea sandstone as can be seen by projecting ledges of iron stained sandstone flags. Just south of here on the west side of the river there are hummocky step terraces which may have been preserved by the resistant sandstone ledges below

DESCRIPTION OF THE VALLEY OF THE EAST BRANCH OF ROCKY RIVER FROM BEREA TO THE FORK AND THE VALLEY OF THE MAIN STREAM TO THE LORAIN ST. BRIDGE.

Just north of the town ~~of Berea~~ the stream ~~falls~~ cascades over Berea sandstone making a high waterfall below which the gorge is deep and rugged with bold promontories of sandstone, caves and undercutting while the streambed has potholes and rapids.

A half mile north of the falls, sandstone is no longer seen in the gorge side; instead Bedford and Ohio shales crop out. ~~There is~~ A tiny alluvial fan in one place composed of Bedford shale waste, ~~and~~ rests upon the darker blue Ohio shale. Three small drift sections in the valley walls within a short distance below Berea ~~There is a small drift area on the east side of the gorge~~ indicate buried valleys. ~~within a mile north of Berea there are two more such drift areas.~~ Over a mile and a half north or Berea there is a lateral high up on the valley side which is about to be cut off by a lateral flowing normal to it. It will soon become a hanging valley some fifty feet above the present stream level.

In about 2 miles (bee line) above the confluence of the Branches, East Branch has 8 good meanders. As they developed they became entrenched and began migrating down stream. None has yet moved its width but most of them have shifted partly out of their initial curves.

On the east side of the stream ~~there~~ are may tiny parallel channels. Here is also a deserted floodplain higher than the present floodplain. On this ~~high floodplain~~ terrace is a fan which gives a clue to the age of the ~~lower one~~ present floodplain because the amount of time represented in the making of the fan would not exceed that which the stream took in the cutting of its present channel and the making of the lower floodplain.

~~Four miles southwest of the Lorain St. bridge the East Branch of Rocky River meets the West Branch at Cedar Point; from there north~~ Below the isolated hills the valley widens and frequent terraces have been carved. ~~are trimmed off. The floodplain is even and level and not hummocky as it was upstream.~~ Abram Creek enters the main stream a mile ~~north of~~ below the fork in a rocky gorge. Two miles up stream a meander in East Branch ~~shows the convergence of drainage toward the Rocky River embayment; from here north the gorge becomes broader, steeper sided, and deeper.~~ threatened to capture Abram's but turned aside in time to avoid the piracy. Two miles south of the Lorain St. bridge a small tributary ~~about a mile in length~~ on the east side enters the main valley ~~stream; the direction of its course is southwest~~ headed upstream. It must have had to dodge a subordinate ridge of the Maumee shoreline before entering the lake; ~~for its direction is parallel to the Maumee shoreline.~~ then when the lake fell, the river came and took it in. The main stream is now endeavoring to take this tributary in, nearly one half mile above its present mouth. It would then be a splendid hanging valley, with an abandoned valley behind an isolated hill.

Just south of the Lorain St. bridge there is a long isolated hill fifty feet high, composed of drift; to the east are three ravines ~~showing that the valley to the east of the isolated hill was carved by them.~~ leading into the abandoned valley behind the hill. It seems probable that the main stream once ran east of this hill and swung west in two meanders one before going ~~The combined action of the ravines and the main stream made possible here a long isolated hill.~~ behind, the other after. Subsequently these meanders cut into each other and the river left the course east of the hill for one west. Drift is exposed in the ravine farthest to the south, shale and drift in the middle ravine and drift in the ravine farthest to the north. This whole problem is worked out in a buried valley probably the one occupied by Abram's Creek farther south. The buried valley is known on the west side from here to the lake.

The points to an isolated hill of shale in the middle ravine in the old drift-buried valley. The mouth of this buried valley is found at Kings Camp two miles west of the present mouth of Rocky River (2). The drift areas noted above and the drift area around Abram Lake may be a part of a buried Rocky River valley. According to Leverett's (2) report the buried valley parallels the present gorge two miles to the east from Kings Camp to Bingla where it turns southeast and becomes concurrent with the present upper Rocky River Valley of the East Branch.

¶ Summarized, there several notes on the buried valley, it may be stated that an old preglacial valley partly filled with drift from south east of Huckley almost to Berea is occupied by East Branch. In places the stream touches the old rock walls. The buried valley leads almost straight north, across the lower mile or so of Baldwin creek, east of Berea and the Fairgrounds through Abram swamp and creeks, to the Big Four tracks then on north without a stream until it is crossed by Rocky River just above Lorain Street. From here it leads to the lake on the west side of the present Rocky River.

(33) Newberry J. S. Ohio Geol Surv. 1878 v. 1 p 171

2 Leverett Frank Glacial Formation of the Ohio and Erie Drainage Basins. U. S. Geol Surv. Mon. 41 p 617

~~DESCRIPTION OF ROCKY RIVER GORGE FROM THE MOUTH AT KINGS TO THE LORAIN ROAD BRIDGE.~~

For a mile north of the Lorain St. bridge Rocky River has a broad level floodplain, lying at the bottom of a 90 foot shale gorge, on the west side of the river; on the opposite side of the stream there are high escarpments of Ohio shale weathering crumbly. The gorge is from eight to ninety feet deep here, but at the end of the mile, the valley becomes very narrow and the river is still at work entrenching its meanders in its wide floodplain. A mile northeast of the Lorain St. bridge and the river turns west around a big meander loop then eastagain and north. The large loop is not a true meander but is due to the effort of the stream to get through the old Whittlesey beach. the river makes a long meander loop to the west where ravines at the west end of this loop the bluffs as well as those of the little outer from the southwest. The sides of these ravines are composed of drift. This drift area as well as those cited south of the Lorain St. bridge may be small preglacial drift filled tributary valleys of the main preglacial Rocky River valley which parallels the present gorge two miles to the east

cited of a continuation of the large buried preglacial valley "2 miles above its mouth"

~~from a point fifteen miles south of Lake Erie to the lake shore at Kings Camp(1).~~

Middle, or the Lake Whittlesey Ridge encroaches (~~see accompanying figure~~) from the west on the outside of the long meander loop mentioned above, and continues again as one of the prominent lake ridges of northern Ohio. In Whittlesey time Rocky River was deflected westward by this shoreline until it found a weak place where it embouched in the present north and ~~south~~ turn of the meander. Undercutting at ~~both~~ ends of the ~~meander~~ loop may ~~someday~~ produce an isolated hill.

North of the meander the river flows straight north for a half mile; here the shale banks are moderately steep. The river swings first to one, and then the other side of its narrow floodplain. The floodplain appears to the observer at the top of the gorge as long slender ovate beads strung on the blue ribbon of the river.

A mile south of the lake shore road bridge the river meanders to the west and thenflows straight north where the gorge is wider and deeper; the precipitous gorge walls are composed of grayish blue shale.

~~1 Leverett Frank U. S. Geol. Surv. Mon. 41 p 617~~

~~DESCRIPTION OF ROCKY RIVER GORGE FROM THE LAKE SHORE ROAD BRIDGE TO THE MOUTH OF THE RIVER~~

At the lake shore road bridge the river has carved out for itself a steep sided gorge whose walls are composed of grayish, drab, fissile shale, very thinly bedded. Just north of the bridge there is a sandbar whose long axis is parallel with the river course; this bar is composed of reddish alluvium.

At the very mouth of the river, jutting out from the east bank is a double hooked spit, built by alternate deposition by river current, northeast lake wash and west shore current.

On each side of the mouth stand high promontories, (bold "sea cliffs") of Ohio shale[32], showing below, a lower concave elongated curve of water erosion, and above, a rounded convex curve of subaerial erosion. The lower curve is the more prominent so that these bluffs stand out in strong relief silhouetted against the morning sky. ~~(Plate VII)~~

32 [32] Gilbert G. K. Topographic Features of Lake Shores. 5th Ann. Rept. U. S. Geol Surv. p 83

PLATE VII

Lake cliff at the mouth of Rocky River

Hooked spit at the mouth of Rocky River

The gorge of Rocky River just south of Rocky River Station.

DISCUSSION

There are some significant features in the physiography of these river valleys that need fuller explanation than has been given them in the descriptive matter. Let us first turn to buried valleys. Buried valleys are not of unusual occurrence in glaciated areas. ~~J. S. Newberry has noted the presence of the preglacial valleys of Rocky, Cuyahoga and Grand Rivers (1)~~

There are two kinds of buried valleys; those with gentle mature sides and bluffs ~~steep~~. The latter may be gorges excavated in an interglacial period or immediately before the Glacial period when the ice dammed up the lower parts of the valleys and drainage was forced to reverse. and go overdundee. The former are broad mature to old valleys of really Pre Pleistocene time.

In the area under discussion buried valleys are found in several places on the Sandusky River between Tiffin and Fremont, one at Fremont, one in the Huron River a mile north of Monroeville, one at Beaver Creek two miles south of Lake Erie, one in the fork of the Black River at Elyria and one in the lower part of Rocky River whose mouth is at Kings Camp two miles west of the mouth of the present Rocky River. There seem to be almost if not entirely of the gorge type.

In his report on the Erie and Ohio Drainage Basins Frank Leverett calls attention to the work of J. S. Newberry and D. T. Gould in tracing the ancient Rocky River valley from Kings Camp at Lake Erie to Strongsville Township two miles to the east of the present channel. This accords with what evidence has been collected by the present author, except evidence was not found to show that the present East Branch of Rocky River follows the ancient course above Bagola. (1)

The buried valley may be traced as follows; from the lake southward etc. Tracing it up stream then from the lake southward, its course can be followed from Kings Camp Southward 2-3 miles whence it bears eastward and is crossed by the present Rocky River where the valley is so wide and the isolated hill of drift occurs. Absence of rock on the present valley walls is the best evidence that the ancient valley is here. Its exact course for 2-3 miles southward from here is not known but there is no doubt of its presence at Abranis lake a mile east of Berea. The old valley seems to lead north and south even here and to cross Baldwin Creek. South of the old fair grounds and East Branch about where the B & O. R. R. crosses. Baker Creek is on the rocks all around the vicinity of Vigil. The stream east of Strongsville is also on the rocks, and bed rocks shows along the east and west roads between these streams hence the buried valley can be traced no farther south than Nimole. Its course is not known at all above this locality.

The buried valley exposed in the Huron River north of Monroeville and the one exposed in Beaver Creek two miles south of Lake Erie show steep buried escarpments of Ohio shale. These gorges must have been carved out by streams which were rejuvenated upon the retreat of the ice in an Interglacial period. These valleys could not have been preglacial because at that time the surface was carved into broad open valleys. Probably most of the buried valleys in the area studied where there is an abrupt descontinuation of bedrock, are valleys of this type. These gorges were cut in large old pre-glacial valleys or across divides from one valley to another.

FIGURE V

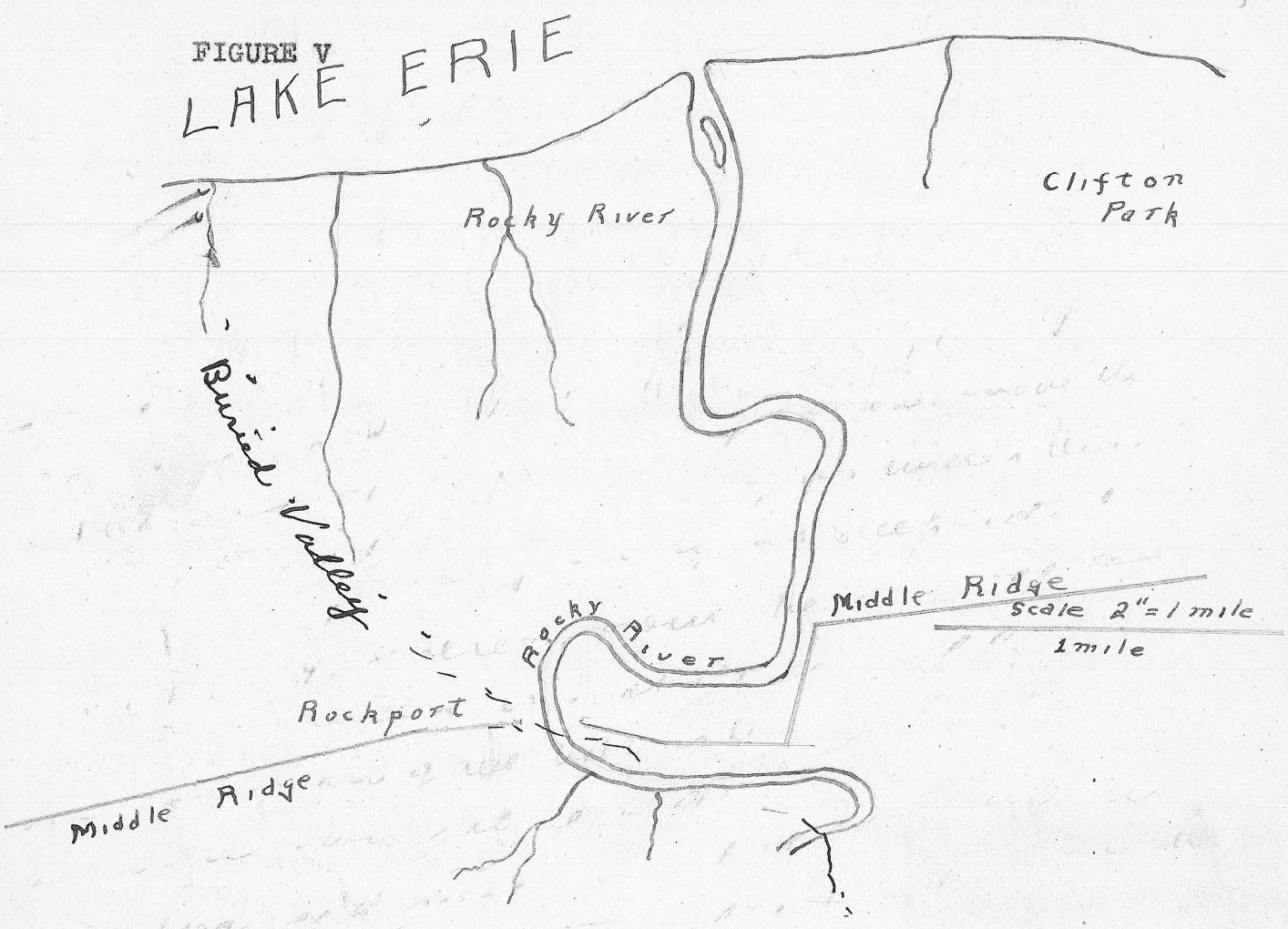


Fig. showing the preglacial river mouth of Rocky River and southward continuation of this valley of buried drift as revealed from uncovered drift filled depressions.

Evidences for the wide preglacial valleys are found in the present lake embayments and in the depressions or drainage basins which converge toward older lake embayments, as seen by embayments represented by large curves in abandoned lake ridges; further buried valleys are actually found in these drainage basins. Old rock hills with slopes of 2-3 degrees are found in many places in our area. These are the higher lands between the valleys, or the present walls of the very mature, buried, prePleistocene valleys. Such hills barely protrude now through the drift, one may be seen 1½ miles south of Berlin Heights, another across East Fork-Vermilion north eastward from Kipton, and at otherplaces. In the summits of several of them quarries for the sandstone have been opened.

A second topic for discussion is that of river terraces. Terraces in our area are not as well pronounced or as common as might be supposed. In the first place in the lower part of the river courses where terraces were formed, the developement of gorges and migration of meanders have trimmed off most of them. In the second place in the upper part of the river courses where terraces are developed, the loose texture of the drift of which they are composed offers no resistance to surface drainage so that soon the terrace fronts are dissected and finally the whole becomes a gentle valley slope

1. Newberry J. S. Ohio Geol Surv. 1878 v 1 p 171

2. Wilson A. W. G. The Laurentian Peneplain J our Geol v " p 645

3. Anderson J. G. Solufluction as a Component of Subaerial Denudation. Jour. Geol v. 14 1906 pp 91-112.

That the absence of terraces in the lower course of the rivers is due to terrace trimming by the stream through its lateral shifting is shown by the presence, of ~~what~~ fragments terraces that do remain in the lower courses of the rivers, on the opposite side of the valley from which the stream now ~~flows~~ occupies. Cases in point are the terraces of Ballville and of Rocky River just south of Cedar Point on the east side of the West Branch. Another evidence of the terrace trimming is the presence of remnant terraces capping overhanging undercut bluffs. The next flood season may find the stream on the opposite side of its valley undercutting terraces that now seem perfectly safe. Many examples of this process can be found anywhere in the valleys on a much smaller scale.

While many of the terraces here cited are due wholly to normal down cutting as seen by absence of terraces near the river mouths and by the present process of down cutting, not a few, indeed may be due to an interrupted erosion cycle. Examples of ~~these mature~~ such terraces are found in many places just south of the old lake shorelines where the rivers are now entrenching themselves because of further rejuvenation on account of the further lowering of the lake level. These terraces ~~are rolling~~ have rolling uneven tops and are sub-mature in appearance.

A third topic of interest is the correlation of valley type with character of rock; There are four types of valleys in the area; the shallow limestone valley, the shale gorge, the V-shaped drift valley and the sandstone valley.

The streambed of the limestone valley is rough jagged, rocky and corrugated. The river banks are low and craggy with numerous undercuts; Potholes are an important feature of the river bed. The floodplains are broad and undulating; There are a few narrow rock terraces but generally the ~~valley side~~ bluff rises from the floodplain with a gradual slope to the ~~lake~~ plains above. The rivers of limestone valleys have straighter courses and lower banks than those in the other types of valley ~~primarily~~. The shallowness of the valleys is primarily due to the general lower level of the land.

The shale gorge as exemplified in the gorges of Huron and Vermilion, Black and the lower part of Rocky ~~River~~ has high vertical bluffs ~~sides~~. From the ~~Till plain above~~ uplands, the valley is not noticed until its very edge is reached.(1) The gorge floor is usually wide near the mouths of the streams. The streams meander back and forth from one side of the winding gorge to the other. All the phenomena of the erosion of soft sedimentary strata are found, such as fans, fan deltas, sand bars, small alluvial plains, little islands, meanders and meander cutoffs.

The V-shaped drift valley is in direct contrast to the foregoing types. Its valley sides are very hummocky; interlacing terraces, small rounded promontories and heaps of glacial ~~boulders~~ drift are other features of the valley side. The course of the stream has an ~~very~~ irregular outline with sharp turns and local rapids and dams of glacial boulders. The river banks are usually low and composed of glacial drift or gravels. The floodplains are uneven and are cut by many little meanders and irregular ~~laterals~~ turns of the main stream.

1. Dewey Henry Origin of some Gorges in Cornwall
Q. J. G. S. Vol 72 p65

Occasionally
~~Often~~ the valley sides are far back from the stream. The graceful Hogarth curve is often displayed in these valley sides where surface erosion has smoothed off their tops.

The sandstone valley is similar in character to the shale gorge. Where down cutting has gone on for considerable time the ~~valley sides~~ bluffs are steep, with deep craggy gorges ~~are formed~~; where down cutting has not proceeded so long, low rocky banks, wide floodplains and graceful upper slopes are features of the valley. Bold craggy promontories on a small scale are distinguishing features of the landscape. The reason for differences in the types of these valleys may be found in the way in which the rock resists erosion. Limestone is affected largely through solution, shale is weakest along joint planes, drift due to its loose texture is very readily carried away while sandstone very resistant towards solution is weakest towards mechanical agents of erosion.

Another physiographic feature of interest is the isolated hill. Three have been described in Rocky River gorge, three in the upper course of Sandusky River valley while there is one of prominence in the lower course of Vermilion River gorge, just north of where Chance Creek enters the main stream, and a small one at the fork in Huron River valley.

Isolated hills may originate in several ways; they may arise simply as islands by the formation of meander cut-offs ~~and then they will appear as isolated hills~~ when the stream has entrenched itself; or they may be the result of undercutting on adjacent sides of two meander loops in an already deeply incised gorge. They may originate at the confluence of two streams when either or both ~~streams~~ undercut toward each other and so meet farther upstream.

1. Tower G. S. Development of Cut-off Meanders
Amer Geogr. Soc. v. 36 1904 pp 589-590

Examples of this mode of origin are found in the isolated hills at Cedar Point and in the isolated hill at the fork of Huron River.

Another type of origin of the isolated hill may be found in the work of a small lateral in combination with that of the main stream; a case of this type is that of the elongated isolated hill just south of the Lorain St. bridge in Rocky River gorge where three ravines of the east side of the valley have extend out a broad valley to the east of the main stream and so have left the isolated hill between this valley and that of the main stream.

small stream coming into Rocky River headed upstream midway between Lorain street bridge and the confluence of the Branches. The isolation is not quite completed yet.

A good example of the isolated hill derived from the entrenching of a meander cut-off is found in one just north of the mouth of Chance Creek in the gorge of the lower part of Vermilion River where the valley side on the opposite side of the valley from which the present stream flows now, the outline of the old meander and the present stream flows in the cut-off.

gorge behind the hill is while

Another physiographic feature of interest is the parallelism of drainage basins in a part of our area, and the convergence of many of the tributaries toward shorelines of former lake embayments. It may be supposed that these originated since the retreat of the glaciers through the partial occasion by the Lake Erie of buried Tertiary Valleys, which were tributary to ancient Erie Valley, and which still persist strong enough to make embayments in successive abandoned shorelines, and to direct the post-glacial drainage toward their own axes.

The former occur where the abandoned proglacial lake plains descend rather uniformly to the present lake. The latter ~~occ~~ by contrast, are found where there were and, in spite of ice erosion and deposition, which

former lake embayments are found confirming the conclusion above.

~~Thus the parallelism in drainage, falls in line with the parallel~~ tributary pattern of the Tertiary Erie valley drainage system.

SUMMARY CONCLUSIONS.

1 The rivers of the area studied are consequent streams upon the till plain, initial upon the retreat of the glaciers, increasing in length as the ice withdrew, flowing north from the morainic divide at their mouths to successive proglacial lakes.

2 The direction of the streams has been determined by:

(a) General northward slope of the Till Plain in Lake Erie Basin as caused by either;

(1) preglacial erosion resulting in ~~preglacial~~ valleys parallel to each other and tributary to axial Erie Valley, as a part of the great Tertiary valley system of the Great Lakes Region or the bare leveled inter-stream areas down which parallel streams now flow.

(2) Crustal downwarping of the Erie Basin

(3) depression due to the weight of the ice.

(b) Till Plain irregularities such as moraines, kettles, ~~and~~ knobs, and eskers.

(c) Uncovering of buried valleys.

(d) Blocking effect of present and former lake beaches causing streams to parallel the lake shore for a distance before their ~~way~~ embouchure.

3 Gorges, waterfalls, rapids, incised meanders and high terraces are due to repeated rejuvenation of the streams caused by progressive retreating of Proglacial Lake Erie through Maumee, Whittlesey Warren and other stages.

4 The advanced youth of some of the valleys just south of the old shorelines indicates temporary stability of baselevel in the successive proglacial lakes when the rivers worked at grade near their mouths.

5 There are distinct types of valleys whose physiographic features owe their variety to the character of the rock eroded. The types of valleys are the shallow limestone valley, the shale gorge, the V-shaped drift valley and the sandstone valley.

6 Vigorous dissection and denudation of the area is in progress.

a The tributaries of the main stream have a dendritic pattern because slightly modified by irregularities in the drift such as kettles, knobs and eskers and old shorelines.

b Consequent drainage of the immediate lake slope is vigorous.

c Miniature peneplanation is shown in many valley gorges where isolated hills rise as monadnocks from the valley floor.

d Through headward erosion of the main streams higher gradients and the low gradients of the mouth have moved farther upstream and so have allowed the once elevated sections have extended in some cases many miles up stream. ~~parts of the plains across to the lowest levels.~~

7 Convergence of drainage in Huron, Black and Rocky River drainage basins is due to new old preglacial valleys partly obscured by drift. ~~buried valleys (Fig. 1)~~

~~Buried Tertiary valleys (see 2 a) 1 above) explain the convergence of drainage in the drainage basins of Huron, Black and Rocky Rivers and also explain the former lake outlets such as Berea, Tyria and Rocky River Gaps. Such broad mature valleys may be recognized as lying between the low rounded, old sandstone hills rising through the drift in many places in the area studied. Near Florence one buried valley west of Berlin is also in such a hill.~~

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SUMMARY CONCLUSIONS WITH RESPECT TO THE PHYSIOGRAPHIC HISTORY OF LOCAL RIVER VALLEYS OF NORTHERN OHIO

The present river valleys are mostly the result of normal down-cutting in the present erosion cycle; the many terraces are due to normal side to side swinging of the channelw; abandoned channels are often seen on one side or the other of the main river valley; no doubt these channels may soon be utilized at the next flood season or when for any resson the main stream erodes what has blocked up the old channel. It is observed that the deeper parts of the gorges are from within five to twenty miles from the mouths of these five rivers. A nodal effect is seen in most of the rivers where the river leaves the more resistend country and flows over shale ~~/\/\/\~~ke glacial drift or lake clay.

The node is marked in some cases by falls and rejuvenation for example the falls in the Rocky River West Branch at Olmstead Falls ~~x~~ East Branch at Berea where the river falls over a hard resistent layer of Mississipic sandstone; At Elyria further west there are falls in both branches of the Black river ofer the same formation. The same thing is true of the vermillion river further west to a less extent.

Where the falls are larger as is the case with the Black and Rocky rivers the nodal effect is more marked; The valley above the falls has old characteristics, meanders, low banks, is sluggish and the terraces have gentle contours. The flood plains are broad and many islands occur in the river. Below the falls the river valley is narrow; the banks are high; the gorge is deep, terraces are not as well preserved; ~~u/\/\~~ undercutting is more prominent.

About twenty-five miles from the mouths of the river forking occurs; it is observed that where the gorges are below the fall line that is the line ~~/\/\/\~~ of the outcropping of the resistend Berea sandstone, these gorges are just as deep as the main river gorge below the forkes; this would indicate the presence at one time of two converging rivers which now are but forks; it is also seen that the lake ridges are embayed at these points so we may conclude that at one time two rivers flowed where now flow branches of one river.

One strikkng feature of the river valleys in their lower parts ~~a/\/\/~~ is the presence of great irregularity, here an amphitheatre and there a projecting cowl, here a wide embayment and there a sharp cusp. Upon further investigation it is seen that the valley side is not composed of the usually present Devonian shale but of glacial drift and here and there buried escarpments are found showing that the river has found buried valleys of either interglacial time or of preglacial time and in consequence thereof has much more easily eroded a new valley or one might say reclaimed the old valley for itself than ~~/\/\~~ it has carved the Devonian shales of its narrower portions. Such an uncovered valley is found near Oak point about two miles from the lake in Beaver Creek.

keep to form of conclusions.

It was said above that these present river valleys are the result of normal down cutting; for the beginning of these rivers let us look to a time when the glaciers had retreated just far enough so that their proglacial lakes drained westward, northward or eastward, not southward. For under this circumstance, say if the lake drained out through the Maumee- Fort Wayne outlet, the ground morraine i. e. our area being higher than the Fort Wayne outlet would drain northward; the same thing would be true if the outlet were further north through southwest Michigan into Lake Michigan and through the Des Plaines river to the Mississippi and the gulf or as is th4 case at present if the lake drained eastward thro gh Lake Ontario and the St. Lawrence to the Atlantic ocean. .

These riversHaven't been working very long geologically speaking, they have been workingjust long enough to carve A rather shallow gorges in a hard sandstone and relatively deep gorges in a less resistent shale. They haven't been working long enough to produce any very old topography; some relatively old topography is seen at the mouths of most of the rivers where the terraces are all smoothed in together into very gentle slopes.

In the progress outlined above in the lowering of the outlets of the lakes we can readily see a correspondingly steady lowering of the lake levels; this would postulate abandoned lake ridges and lake beaches; these can be found in the Chestnut ridge, Whittlesey ridge and Maumee ridge and hence it might be possible to find rather old valleys upstream which would have had time to have been carved out had the lake level remained stationary for a long enough time. This condition is seen above the nodes in many of the branches. of the main rivers.

Thus we have a consequent surficial drainage from a divide at present some twenty-five to thirty-five miles south of the present lake; the process is been continued re-juvenation by the lowering of the lake level with here and there temporary oscillations and consequently drowning or ponding up of the rivers; most of the mouths of the rivers to-day are ponded back and are being drowned by the tilting of the lake to the southwest Where these rivers have run upon the buried proglacial valleys they have naturally cut out much faster and thereby widened their valleys but their initial direction was probably determined solely by the normal process of natural selection of a comparatively homogeneous body of glacial till and lake clay. By natural selection is meant selection of one rivulet over its fellow and its consequent capture and piracy due perhaps to favourable donditions of supply of water, and materials upon which to flow.

clumsy, careful.

too technical in another sense to use here

Can you find cases of such piracy

In a few cases the original direction of flow has been effected by features of glaciation such as for example the presence of eskars and kames have diverted streams or when sinks or holes in the drift have emponded the river as is seen in the marshes of the Black river near L odi.

Rhetoric

a good start. There are more conclusions